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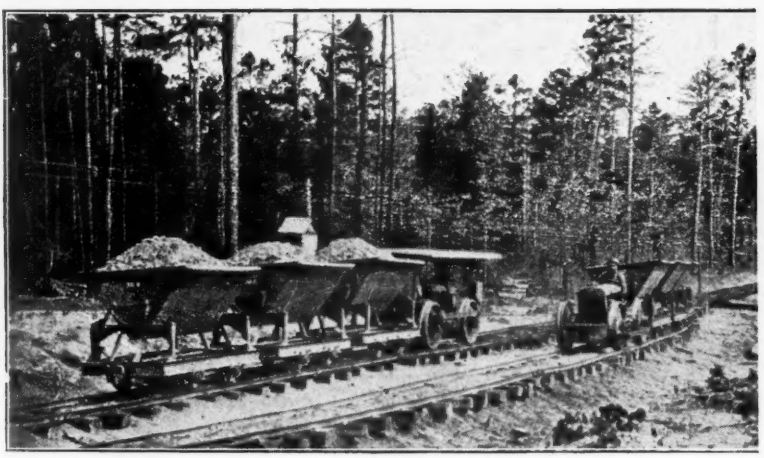
HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING



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October 15, 1924

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Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

VOL. 9 CHICAGO, ILL., OCTOBER 15, 1924 NO. 2

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COMPLETE SERVICE PUBLISHING CO.
Rand-McNally Bldg., Chicago, Ill.

Publishers of
PIT AND QUARRY and Pit and Quarry HANDBOOK

HARRY W. BAUMGARTNER
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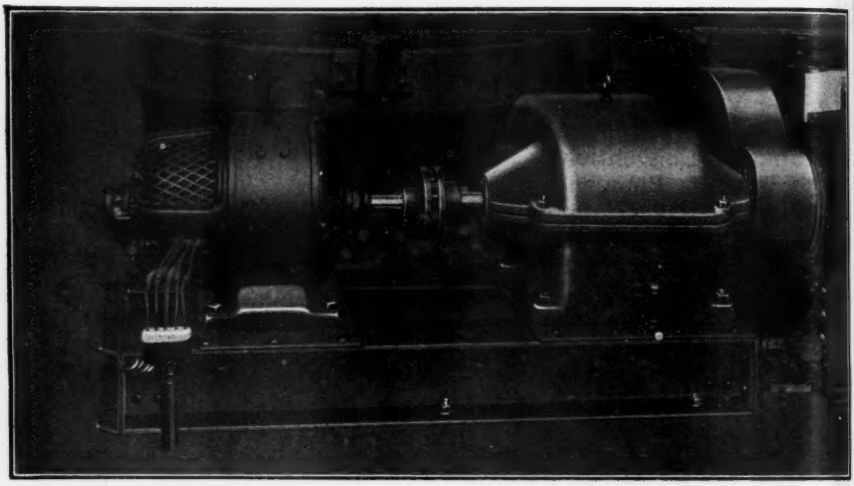
PALMER-BEE SPEED REDUCERS MAINTAIN PRODUCTION AT MICHIGAN STATE CEMENT PLANT, CHELSEA, MICH.



In the editorial section of this issue you will find an illustrated and very complete story on the Michigan State Cement Plant, located at Chelsea, Michigan.

The article is not only interesting in itself, but it also brings to the reader's notice the Palmer-Bee Mill Type Speed Reducer installations that are in operation in this plant and the part they play in the maintenance of the plant's production schedules.

Unaffected by dust or grit, which are so prominent in cement mills, these reducers will run continuously—24 hours a day—giving uninterrupted service while doing heavy duty work under the most severe working conditions. Maintaining production is but one of the may desirable features that the Palmer-Bee Speed Reducers are capable of offering. They save power, increase production, and being a fully enclosed unit in a dust-proof and oil-retaining casing they eliminate accident hazards.

The complete satisfaction that Palmer-Bee Speed Reducers establish, once they are installed and in operation in your plant will prove conclusively our right to distinction in this field of endeavor.

Any data or specific information which might interest you, will be gladly forwarded you without obligation.

Ask for Bulletin 342.

Palmer-Bee Company

DETROIT, MICHIGAN

Pit and Quarry

Vol. 9 Chicago, Ill., October 15, 1924 No. 2

The Value of Perspective

UPON the chief executive of an organization rests the responsibility of making that organization a success. He must direct the enterprize and guide the associated executives. To do this most effectively he must cultivate the ability to keep a detached point of view, to see things in perspective. If he permits the daily routine of business to keep him constantly at the wheel, he cannot find the necessary time or energy to devote to this essential part of his work. Of course, in times of emergency, he will find it necessary to turn his attention to minor details, but under ordinary circumstances he should be free from them.

There are far more important problems for him to consider. He should study his business in perspective, from the mountain peak, as it were. He should make a complete and exhaustive study not only of his own business, his own product, or his own market, but also of the industry to which his business belongs, of general market conditions, of general financial conditions, of the economic conditions of the country, of the conditions and tendencies of business the world over. He cannot be too well informed. The broader his outlook, the better fitted will he be to solve everyday problems.

The chief executive constantly finds himself called upon to make quick decisions, to meet sudden and unexpected emergencies. His ability to stand up under these tests, to act with decisiveness and accuracy depends upon his practice of studying the future and preparing for it. He must have vision and imagination. He must be living in the future while he is directing in the present. He must have creative ability. He must build a picture of the future revealing the development of his business, the expansion of the plant, the improvement of his organization and of its personnel. He must construct a panorama of the future with constantly changing personalities and growing achievements. He must let no obstacle of the present draw a curtain to cut off that scene of activity and endeavor which is just ahead.

The chief executive cannot do all this for his organization if he is overwhelmed with routine work and a daily grind of unimportant matters. He cannot study his business in perspective if he has a weary and harassed mind. Hence he must allow a generous margin of safety from fatigue. A fatigued mind is a dull and timid mind. Sound health and a clear head are essential factors for quick, sure and daring achievement. Hence the chief executive will be wise if he utilizes his ability for organization for the purpose of keeping free from those endless details which seem so urgent. This is one way in which he may demonstrate that he is a real executive.

It is the chief executive who thus organizes his routine work who gains the unstinted respect of his staff. He has energy and inspiration to impart to his minor executives and in this way he increases their usefulness to his organization. He becomes the motive force in his business. In conferences he gives inspiration and enthusiasm to his staff. They may be discouraged, dejected, inert; they may have lost confidence in their organization, their product, or themselves. They may be disheartened because of the success of a competitor, or a fluctuation in market conditions, or a critical labor situation. It is then that the chief executive must call upon his surplus enthusiasm. He will need to meet the situation with optimism and buoyancy and courage. A quiet manner, a fine poise, a pleasant smile, a word of sympathy, a quick understanding of

the difficulty, a wise solution of a problem, an enlightening bit of information, a subtle and far sighted suggestion—these are the sources of inspiration which will send the minor executives back to the job with a certainty that they are going to succeed and they will. But these things do not come from the chief executive who is burdened with annoying details of routine.

To exert such an influence on an organization the chief executive must be versatile. He must acquire a vast range of information secured from outside contacts; from reading, thinking, and observation; from maintaining a keen mind and a healthy body. Executive capacity is more than an intellectual quality; it is more than an ability for organization. It is a constructive or a creative capacity. It requires opportunity for observing the business in perspective, for working out future plans and policies. The possibilities for developing such a position are unlimited and are vitally concerned with the future of any business enterprise.

Accident Prevention

THE safety movement is really an educational movement, an effort to reach the rank and file of workmen and to get them intelligently interested in protecting themselves and their fellow workman.

The accident provention work conducted by the Portland Cement Association has demonstrated that nearly all the accidental deaths and serious injuries in the cement industry can be eliminated. This accident prevention movement also affords a legitimate common ground on which the employer and employee can meet with mutual interest and profit to both. The results accomplished are largely due to organization and educational methods through reaching foremen and getting them convinced and "on the job" and through them reaching the workmen and getting them interested in protecting themselves.

The manager of the plant must be absolutely convinced on safety, and once convinced he must get back of it so unmistakably that not a foreman nor a workman will doubt for a moment what he is willing to do to make the plant safe and what he expects them to do. He must do his full part before he can expect his men to take safety seriously. The manager should bring his foremen to believe in safety as they believe in production. The attitude of the workmen toward safety practically depends upon the attitude of the foremen. The foreman who is convinced of the need for safety work, who carefully instructs his men and who convinces them that he is doing everything in his power to protect them will get their cooperation. A foreman must lead his men into safety work, not drive them.

Frequent conferences and discussions of the experience of other companies which have done successful safety work will help. One man should be made responsible for safety in the plant. He should if possible be given an opportunity to visit plants that have done effective safety work. Pictures and items in the form of bulletins that illustrate what the workman can do to protect himself are effective.

Every industry that has done efficient safety work has found it pays good dividends. Safety is recognized as an organization. It is not only good ethics but it is good business.

Coming Conventions

JANUARY affords an opportunity for producers of sand and gravel and crushed stone from all sections of the country to get together for the purpose of studying conditions, comparing results and exchanging ideas for mutual benefit.

Preservation of the competitive system of industry depends upon the ability of producers to solve their problems through collective action. Competition and cooperation are being put on a sound scientific basis through trade associations. There are untold possibilities for future development through the trade associations in the non-metallic industries.

Remember the National Sand and Gravel Association Convention in Chicago January 5th to the 15th, and the National Crushed Stone Convention in Cincinnati January 12th to the 15th. The Road Show will be held in Chicago January 5th to the 9th giving an added incentive to producers to attend the Sand and Gravel Convention.

The Tri-O-Lite Products Company Mines Diatomaceous Earth

Unusual Non-Metallic Ore Economically Prepared for Market Must be Delivered Intact, Light Weight, Free from Moisture

THE mill and properties of the Tri-o-Lite Products Company are located three miles east of Carlin, Nevada, on their siding known as Vivian, Nevada, on the Ogden San Francisco line of the Southern Pacific Railroad. They own a commercial deposit of Diatomaceous Earth (Kieselguhr) and are actively mining and refining this non-metallic ore for commercial purposes. Briefly, their holdings aside from deposit consist of land for transportation and building purposes, roads and road rights, a railroad spur track 600 feet long, buildings for housing employees, storage facilities, and milling equipment.

The deposit may be said to originate one-half mile directly north of the main buildings, extending almost north but slightly west in parallel lines of broken stratas for nearly two and one-half miles. The face varies from 20 to 60 feet thick at surface, and dips into sides of low hills at an angle of about 25 to 30 degrees. It is protected by massive volcanic ash hanging and foot walls in its entire length. The structure is intact and the supply abundant.

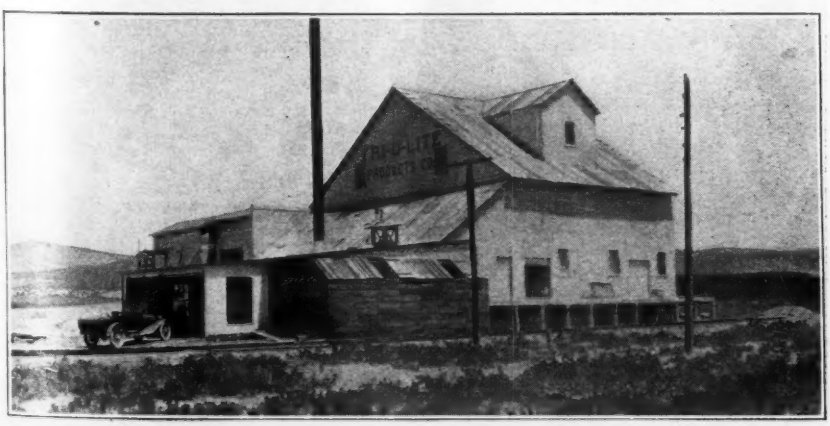
Connecting mine and mill is a good graveled road suitable for heavy trucking in any time of year.

Before proceeding further with the description of the mining and milling methods and operations, it might clarify later statements, if a word were said about the product to be handled, and the why and wherefore and importance of certain points later to be described.

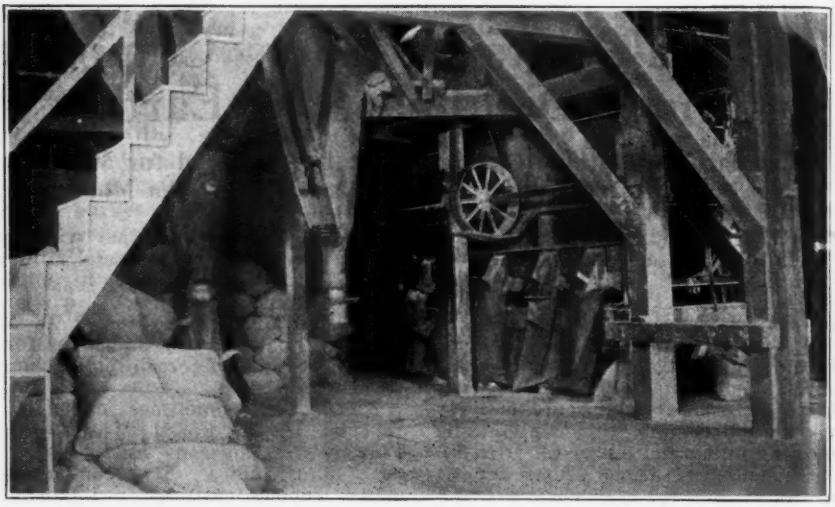
Kieselguhr, sometimes called Infusorial Earth, Fossil Meal, Fossil Flower, Diatomaceous Earth, etc., is not plain silica. Its commercial values depend entirely on its structure, chemical purity, location geographically with regard to good and dependable transportation and ability of those handling it to get it to the market with the greatest amount of that structure intact, and with the least amount of moisture present.

The non-metallic ore of the Tri-o-Lite Products Company is pure white in color, contains about 43,000,000 barrel shaped diatoms or cells per cubic inch, is almost pure Silicated Aluminum chemically and is abundant in quantity. The average haulage from center of deposit to railroad is a bare 1½ miles.

From the above will be seen the importance of producing a voluminous ore economically so as not to injure the delicate structure, and transporting and preparing it for the



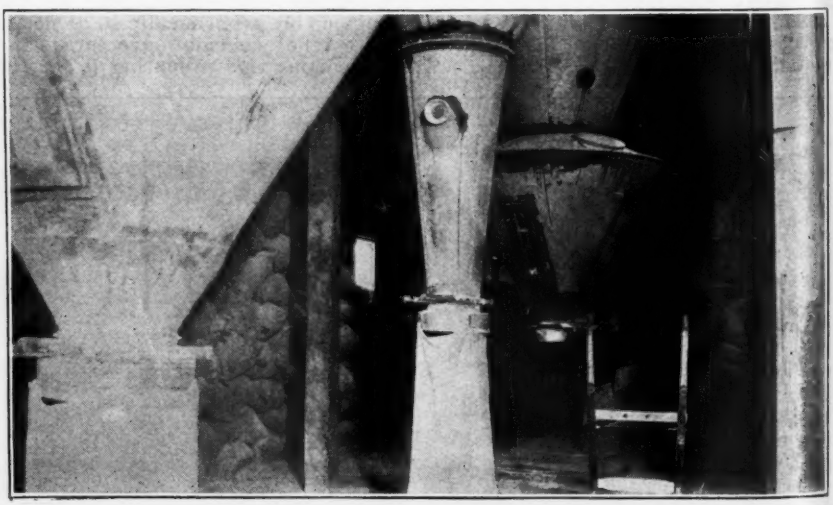
View of the Main Mill Buildings.



View in Front of Grader On Main Mill Floor.

market without injuring any more than possible its structure and at the same time delivering it as free from moisture as possible. Of all the diatomaceous earth producers' problems, the question of delivering a light weight product is one of the most essential.

Ore from this deposit averages from 28 to 40 pounds per cubic foot, per mine run wet ton, while the dry product averages from 15 to 26 pounds crude and from 6 to 15 pounds after milling. It has been found that the best milling state of crude is with a moisture content of 5 to 7 per cent although it can be milled, without serious danger of breaking up a high percentage of structure, with as high as ten per cent moisture content. Of especial interest is the fact it can be too dry also. When a product of a two or lower percentage of moisture content enters pulverizers, it flows like water until in the mill and in the packers it is practically impossible to handle as it will not pack into containers on account of



View Showing Sackers of Three Cyclones.

its powerful affinity for moisture. It is possible to get a product like this dry only in artificial driers.

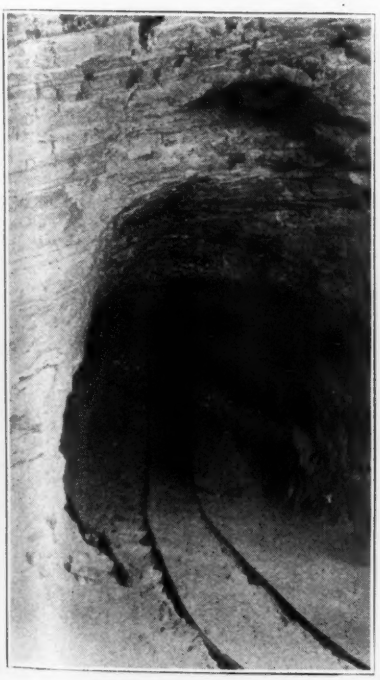
Shafts, of which there are five, are sunk on top of foot walls in the ore to a suitable depth to get under reasonably large volumes of ore. When levels for tunnels are reached, the tunnels are run out at right angles to inclined shafts along the foot walls. Crosscuts are then put in. Large stopes are opened up, leaving at regular intervals a pillar to support roofwalls and the material is blasted down in cars, which are hoisted by means of tram cars on 24 inch gauge trams to the surface. The cars can be dumped on either side and have a capacity of 36 cubic feet each. Standard 12 pound "T" rail is used on account of weight. This gauge gives stability for large cars. Hoisting is done with a Fairbanks-Morse single drum type hoist, operating ½ inch steel cables.

At the surface, the cars are either dumped on large drying platforms of which the company has two, of 6,000 square feet each or into a large wet storage bin of 50 tons capacity. All bins are thoroughly supported on heavy timber work and have good corrugated iron roofs to keep out sudden rains which retard the drying process.

Aside from the above equipment the company maintains proper storage tunnels for explosives, barn for animals, and a good bunk house for miners at the mine. Water is trucked to mill. This was one reason for locating the mill at the railroad rather than at the mine. Only a small amount of drying is attempted at mine.

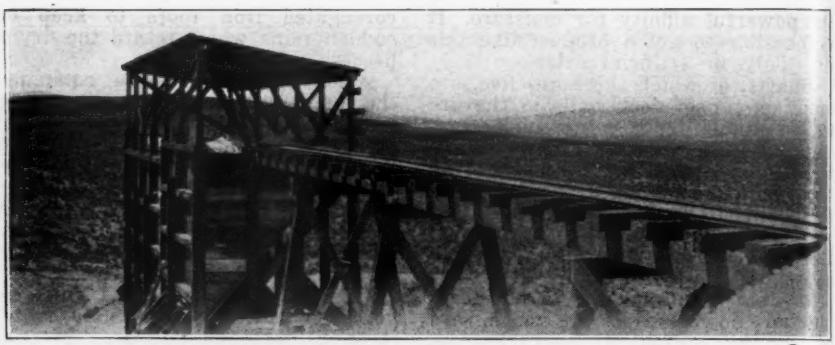
This company has found from experience that ore once badly frozen is badly damaged if frozen in mine run condition. A high percentage of structure is broken and after drying and milling, it contains a high percentage of silt. Wet material is taken in winter months from the mine to the mill in the minimum of time and large storage is avoided. From either platforms or bin, the crude material is dumped into automatic dumping trucks, which convey the crude ore to the mill.

The main mill building is 60 by 60 feet and houses all main mill machinery, power plant, mill office, both wet and dry receiving bins, etc. To the north of the receiving bins and



Bottom of Shaft No. 5.

View Showing Part of Deposit Height.

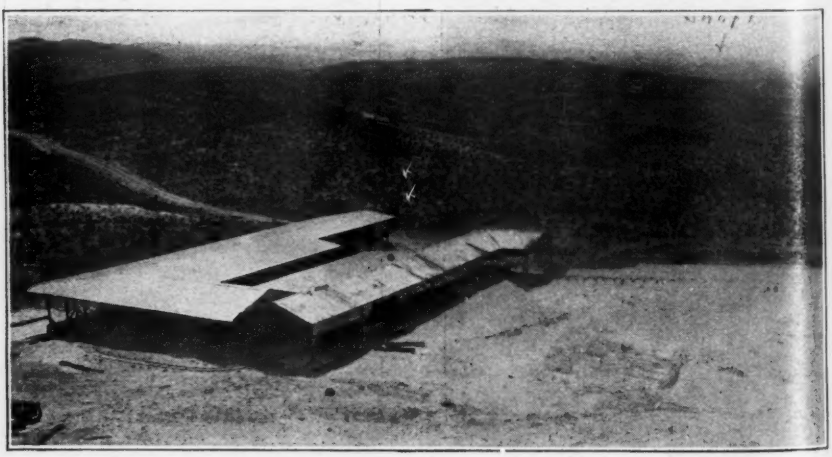


Mine Wet Storage Bin Show Timber Approach.

drier building is a power plant 96x12 feet. To the west of the power room are a boiler room, garage and machine shop, and coal bin, all under one roof 38x38 feet. All of these buildings are frame, with either corrugated iron or shingle roofs. All heavy machinery is timber supported in its own concrete foundations. Pits and foundations are all of heavy substantial concrete construction. There is a watchman's cabin, a residence for the engineer, a 15,000 gallon capacity concrete tank for fuel oil, and a trestle built for trucks to go up and dump through a trap and slide crude ore direct into cars. A railroad spur runs along the mill loading platform, coal bin, and loading trestle giving added space for loading or unloading cars.

The milling equipment consists of the following items: artificial drier, conveyors, hammer mill, automatic grading machine, fans and cyclone collectors. The drier is in itself a separate unit and may be operated when the balance of the mill is shut down. Its power is furnished by a 24 H.P. steam 8x10 inch horizontal engine working on 100 pound pressure, which is belted to a line shaft which in turn drives the conveyors feeding it and the discharge screw conveyors. Steam is furnished by a portable locomotive type Erie boiler of 60 H.P. at 100 pound pressure. Coal fuel is used in the boiler.

All the other units in the mill are driven from a 4 inch line shaft, power being furnished by a 60 H.P. Venn Severin Semi Diesel hot head engine, which is belted to the shaft. In the engine room, are a small compressor and air tanks furnishing air for starting the main engine, other smaller tools about the mill and machine shop, a water pump, high pres-



View of Mine and Drying Platforms.

sure steam pump for fire protection, auxiliary smaller engine, circulation pumps, etc. Further fire protection is afforded by a storage tank on top of the main mill building.

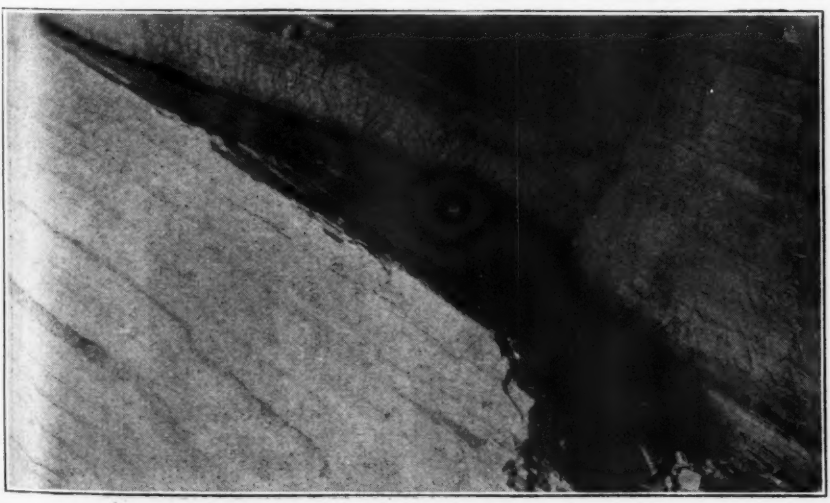
The wet crude material is deposited into receiving bins from trucks. In the bottom of these bins is a traveling chain conveyor, two chains pulling lugs 14 inches long under an angle steel breaker. The speed of this chain is so regulated together with clearance under the breaker that it accomplishes two purposes, that of regulating feed to the drier and to the auxiliary pulverizer. While material is wet, lumps can readily be chewed off in this manner without serious injury. This deposits the ore into a vertical bucket conveyor, 26 feet long, which in turn drops it into the receiving end of the drier proper. The drier consists of two sets of twin steam compartment conveyors, set up on steel frames, in a steam heated room. The material falls into the upper set, and is progressed along slowly by steel paddles over a steam heated surface traveling at 10 R.P.M. These troughs are 16 inches in diameter, 80 feet long and with a pressure of 60 pounds of live steam, averaging over 200 degrees F. at their inner surfaces. The effect is to slowly agitate the material while drying, and yet not make it severe enough to create a dust problem. All dried powder passes out with vapors through ventilators. About 40 minutes is consumed by the ore in traveling this 160 feet. The ore passes down the first set of troughs and back to starting end in the lower two where it falls by gravity into an eight inch screw conveyor, which conveys it to dry receiving bins of the main mill.

Coils of steam pipes under both bins serve to keep the material from freezing and caking up in cold weather and also keep the condensation down in the dry bin. For heating purposes, exhaust steam is used.

At the bottom of the dry bin is a belt conveyor, with angle lugs every two feet which passes under a breaker with a given clearance. This acts as an automatic feed to the main mill hammer mill, into which this belt conveys the ore. There are no longer any lumps over ½ inch in diameter in the ore.

The hammer mill has a 36 inch diameter casing, 30 inches wide. Its core consists of steel strips ½ inch thick by 4 inches wide keyed so that only a ½ inch clearance exists between them or the outer-shell. The speed is 1400 R.P.M. The material is fed against the direction the mill runs for the reason that impact fines are drawn off by air suction from this mill before it travels 15 inches of circumference. It was found the efficiency was increased about 25 per cent in fines by operating the mill this way. Coarse ground material drops through a screen in the bottom into a large bucket elevator, which conveys it all 41 feet up to the top of an automatic grading machine.

These grading machines merely by



View of Shelf About To Be Blasted.

means of passing material over various suctions and screens separate out materials sized for the product wanted, and return all oversize materials through a belt conveyor to the original receiving bin.

In front of these graders is a large 42 inch double type mill exhaust fan, which sucks all fines out and puts them through a series of cyclone separators. Underneath each is a settling cyclone and a 16 inch sliding valve. Sackers work under these bins collecting the products and sewing them up in 30x45 inch burlap bags. In cold months all air entering these machines passes over steam coils, which reduce the chances of condensation setting in the material before sacking. After that it more or less insulates itself.

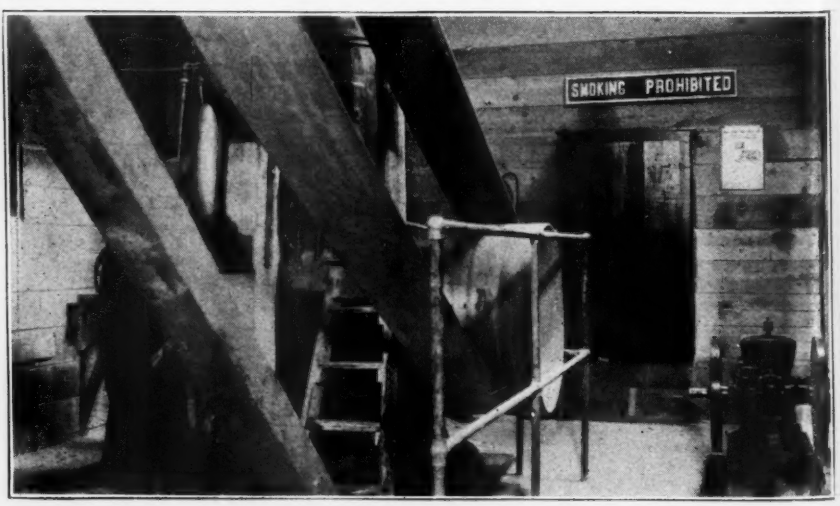
The whole plant may be said to be a balanced unit. Its capacity is 30 tons per day, although under stress more has been produced. Though not large in tonnage when volume and H.P. are considered, the plant is large.

Five products of varying degree of fineness are produced in one operation. Some coarse ground products of remarkably light weights and absorptive powers, with practically no fines, have been produced by this company which are especially valuable to certain industries. It is an easy matter to reduce all of a fragile product to fines but another thing to keep them out. In mesh product, all the way from 30 plus to impalpable powders are produced.

The company plans to increase production soon and to build a tram to the mine.

The drier conveyor system was built by the Ellis Drier and Elevator Company of Chicago who also furnished the drier. This drier was designed jointly by Mr. Norman Ellis of the Ellis Drier and Elevator Company and Mr. C. T. Hurd, the general manager of the Tri-O-Lite Products Company and built in the shops of the Ellis Drier and Elevator Company.

The entire mill conveyor system was designed by the Tri-O-Lite Products Company themselves and built by the San Francisco Mills Furnishing Company of San Francisco. The main pulverizer was designed by Mr. C. T. Hurd, the general manager, and built by the Nevada Engineering and Supply Company of Reno, Nevada. Transmissions and belting were furnished by the Harron Rickard and McCone Company of San Francisco. This same company designed and furnished the air piping. The two large 42 inch double exhausters were furnished by the Buffalo Forge Company. The circulation pumps, power heads and high pressure pumps were furnished by the Worthington Pump and Machinery Company. All piping except air was furnished by the Crane Company. The cars and track were furnished by the Koppel Industrial Car and Equipment Company. The mine hoists were furnished by the Fairbanks Morse Equipment Company.



View of Main Engine Room Showing Semi-Diesel Engine.

Principles of Group Insurance on Life and Health

Written Expressly for PIT AND QUARRY by DWIGHT INGRAM.*

INSURANCE seems to be essentially negative. The maufacturer buys fire insurance merely to avoid the chance of being burned out of his life's work. He buys liability insurance to keep from being ruined by a law suit.

In this field of insurance, however, there has recently grown up a young giant that is not negative in character. For group life and health insurance is quite definitely constructive. For the first time the employer who buys an insurance policy is buying something more than a guarantee against grief—is buying something to build his business by checking the labor turnover.

Group insurance is seldom sold by the conventional methods. The broker or solicitor cannot howl calamity and hurl insinuations of coming death as he may do when he sells an individual life insurance policy. Group insurance is either an expensive toy or it is a self-explanatory business proposition. The result is that "group" is less often sold by high pressure talkers than it is bought by the direct choice of employers whose business it fits.

Group insurance is bought for one or more of the following three reasons:

To avoid unscientific charity. Employers are human, therefore they are conscientious. And when, as so often happens, an employee dies leaving his wife and children penniless, the "boss" digs down into his own pocket for funeral expenses and the unpaid grocery bill. Group insurance eliminates these doles and puts the expense on a definite budget basis.

Secondly, group insurance is commonly used as a Christmas present. The premium is just about what most corporations give as a present in some form, and the insurance policy looks bigger than a five or ten dollar bill.

The third and principal reason is to secure or enhance the employees' good will and loyalty to the corporation. A man is not so quick to walk out of a job when his life insurance is automatically cancelled. Workmen even more than their superiors know that they need protection. Because of age or some physical defect 20 per cent of our employees cannot buy individual life insurance policies. Nearly 60 per cent carry small "industrial" life policies on a weekly payment plan, under which their premium is from four to six times what the employer pays for "group" with its lower overhead. The workman's gratitude is in proportion to the big price which he would have to pay, for he has no direct interest in the employer's actual cash outlay.

Of one thousand persons whose claims were paid within a short period of time by one company

346 left no estate in the form of quick assets.
300 left less than $500 each.
139 left from $500 to $999.
127 left from $1,000 to $1,999.
62 left from $2,000 to $4,999.
26 left $5,000 or more.

That is why wives and mothers believe in insurance, and the employer has won the fight for loyalty and efficiency when he has the folks at home on his side.

"Group" is insurance for either life or health of all or most of the employees of a corporation. For life insurance the lowest rates can be secured only for groups of fifty or more. The corporation can divide its employees into classes according to duties or length of service and insure different classes for varying amounts, but no individual can be excluded or treated differently from the rest of his class.

The amount of life insurance for each employee is always at least $500 and seldom more than $2,000. Each employee designates his own beneficiary. Besides the death payment, total disability is granted a monthly allowance.

The machinery for handling group life insurance is simple. The corporation holds a master policy which outlines the plan of insurance. Each employee receives a certificate which bears the name of himself, his beneficiary and the corporation, together with the amount he is insured for,

*Engineer, Moore, Case, Lyman and Hubbard.

and looks like a regular individual policy. Once a month the employer sends to the insurance company a list of men who have been either hired or dropped, so that the premium can be adjusted at the end of the year.

"Group" policies are very flexible. The employer can buy almost anything he wants. Therefore the biggest problem is to find the right amount of insurance. Do you want to reward length of service? Or give the most insurance to your most valuable men? Or show complete democracy and treat everybody alike? You can arrange to have each policy begin at, say, $500 and increase $100 a year until a maximum of $1500 is reached. This form especially rewards continuity of employment. You may grant an extra amount of insurance to your superintendents and foremen, or make the policies proportioned to amount of salary. This form gives the biggest insurance benefit to the men who are most valuable to your organization. To treat everybody alike with a policy for an unchanging amount of $500 or $1000 obviates any taint of favoritism and sometimes produces a healthy reaction in favor of the officers who put themselves in the same class with their men.

Group accident and sickness insurance lags behind group life in amount sold because it is more expensive. But its principles are just as simple and just as sound. It is carefully designed not to overlap workmen's compensation or employers' liability insurance, because that is almost universally carried. It may pay something to supplement the meager allowances of the compensation laws, but it is intended primarily to cover accidents which happen at home or recreation and also to cover sickness and disease. Probably only about 10 per cent of the time lost by industrial workers through disability is covered by compensation insurance. Most of the remaining 90 per cent of lost time comes from non-occupational accidents or disease. This situation creates the field for group health insurance.

The amount of indemnity for group health insurance can be fixed in three different ways. In the first place, a uniform sum can be available for each man. Secondly, the workers may be classified according to regular wages and a fixed amount provided for each class, as follows:

All Employees With Weekly Wage of	Weekly Indemnity
$21.00 or less	$ 9.00
21.01 to 27.00	12.00
27.01 to 33.00	15.00
33.01 or more	18.00

In the third place, the weekly indemnity may be a direct percentage of the average weekly earnings, including bonuses and overtime. The insurance is usually limited to from 50 per cent to 66⅔ per cent of the total wages, because a larger payment may encourage malingering.

Most insurance policies limit the payment of indemnity for accident and sickness to six months or a year. They also usually carry a provision that no indemnity is to be paid for the first three or seven days of illness. This eliminates the great expense of adjusting a multitude of small claims, and also removes a possible incentive to stay home with some trifling ailment that could be better cured by regular living.

One salient difference between group and individual insurance is that under "group" "the lame, the halt, and the blind" are all insurable, even without a physical examination. Old men, young boys, women, people with weak hearts—all uninsurable as individual risks—are protected in the melting pot of the group policy. The only limitations among most insurance companies are that they do not like to insure big proportions of negroes or Asiatics, and for health insurance they charge a higher rate for women than for men. This broad policy of insuring everybody does not mean that group rates are exorbitant or that the insurers are heading toward insolvency. The theory of all insurance is merely to get a wide enough spread that the risk is distributed. Individual insurance has to be sold by hard work. And naturally the persons most easily sold are those who need it most; that is, the unfit. To keep these down to a fair proportion the companies maintain an expensive system of examination and selection. The employees of a firm under a group policy, however, are a cross-section of humanity itself, with the average quotas of strong and weak, and their loss record is no worse than that of the examined individual risks.

In taking out a group policy there is one pertinent feature that is becoming general. The day the insur-

ance goes into force, usually the day before Christmas, is a big event in any industrial plant. There are noontime discussions of what the management has done, together with comparisons of certificates and of the amount of insurance for each man. It is therefore important that every employee on duty that day should receive a certificate, or one may feel "left out in the cold," and lose the loyalty that the insurance should foster. With new employees who are hired afterwards, however, the case is different. For them the group policy is a desirable asset that is worth staying on the job to get. From the standpoint of the employer we should remember that group insurance measures not the value of a man's services, but rather the value of the continuity of those services as compared with breaking in a new man. If it takes a man two months to learn a new job thoroughly, the continuity of his service is not worth much until the end of those two months. In other words, he is not worth the group life premium for two months. Some jobs can be learned in one day, some in a week and some in six months. The group policy can be arranged to exclude all new employees for the period necessary to learn the job.

What of the cost of this new institution? It is no plaything of the rich, for it is sold purely on merit. As a matter of fact, it costs whatever one wants to pay. The theory is so flexible that a policy can be developed to fit any premium which the buyer names. For life insurance alone some policies are issued for as little as $4 or $5 per capita, though an average cost of $10 is a fairer estimate to quote. Group life alone costs from ⅓ to 1 per cent of the annual pay roll. If health insurance is added the combined cost is from 1 to 2 per cent. These premiums are considered a business expense and are deductible from the federal income tax.

The costs given above cover a big range. The difference between 1 and 2 per cent of an annual pay roll may be enormous. The estimates are not inexact, but the big range is due to the fact that there are two methods of paying "group" premiums. Under the first and more common method the employer pays the entire premium, and hands the policy to the employees "without any string attached to it." The other method is for the employees to share in the cost by contributing a few cents weekly out of their pay. This naturally can produce a much bigger total premium than where the employer pays it all.

Around these two methods hangs the greatest controversy of group insurance. Employers and insurance men both disagree among themselves as to which is the correct principle. Both methods have merit. And the true answer is probably that each plan is designed to fit certain cases. The function of PIT AND QUARRY then is to list the arguments of both sides so that our readers can determine which method to use in their own plants.

Those who believe that a part of the cost of group insurance should be taken out of the pay envelopes of employees urge this not merely as a matter of financial justice, but they also believe that such a course will increase the feeling of responsibility on the part of employees. They say it will keep the workers reminded of the insurance which is being carried for them and which will terminate if they leave the organization.

On the other side it is claimed that the only purpose of having the employee pay part of the premium is to offer the men an opportunity to secure a little insurance at low cost. The contribution of the employees amounts to only two or three cents a day; yet it happens that the most needy men are the very ones who fail to join the plan, for the policies must be voluntarily taken where the men pay. The great purposes of group insurance are an investment in good will, a recognition of faithful service of old employees, and an assurance that the family of every worker will not be left penniless. These purposes are obscured when the employee believes he is paying for the insurance himself.

Group insurance is new, but it is far beyond infancy. Founded less than two decades ago, the amount in force in 1912 was only $13,172,198. The great impetus to its growth came after 1916, and no doubt represented an effort by employers to combat the excessive labor turnover of the war and after-war booms. The insurance in force climbed from $346,000,000 in 1917 to $1,852,000,000 in 1922, and is, of course, well over the two billion mark now. Two million employees working for 10,000 firms are covered by group insurance. During the de-

pression of 1921 group insurance fell off only 3 per cent, and in 1922 it increased 14 per cent during a period when workmen's compensation premiums dropped 25 per cent.

With such a growth has come the establishment of definite principles that are now recognized in the laws of most states, and "group" has won a place near the top of the underwriting field as a form of insurance that is needed, wanted and safe.

The Ever Present Fire Hazard

It is possible for a company which carries insurance to fail because of fire. An insurance policy will never compensate for loss due to suspension of business and the resulting loss of income nor for many other disastrous results of a serious fire. It is, however, good business practice to carry a proper amount of insurance.

Fires are expensive and dangerous and should be prevented by every possible modern method. In a recent issue of PIT AND QUARRY two news items tell of the destruction by fire of crushed stone plants. In one case the loss was twenty-five thousand dollars and might have been greater but for a strong wind that saved the main building. A sprinkler system in the boiler room kept that building unharmed. At the other plant, the loss was thirty-five thousand dollars. If both plants mentioned had been equipped with sprinkler systems, the loss would undoubtedly have been much less. Knowledge of fire prevention methods is of the greatest value to all operators of industrial organizations. An editorial which appeared in the September issue of this journal contained some pertinent suggestions regarding protection against fire. Several suggestions were made regarding prevention of fires and control of them. The importance of carrying an adequate amount of insurance was emphasized. As was stated above, a certain amount of loss is inevitable, but that loss may be greatly reduced if the plant and equipment are well covered.

If a plant is constructed along up-to-date lines, the insurance rate is greatly reduced. It is obvious that a company will insure at a lower rate a plant which is provided with vertical and horizontal isolation, modern type of fire extinguishers, and other devices for preventing and controlling fires.

Fire is the greatest menace that an industrial organization faces. Modern machinery is operated by steam or electricity. This means an increased danger from fire. External causes also offer fire hazards. Passing trains, fires in adjacent buildings, lightning and other outside causes must be considered. The far-sighted operator will study the situation from every angle and will ward off this kind of disaster by wise measures of precaution.

How Will We Meet Our Pulp-Wood Requirements?

In Bulletin No. 1241, dated July 29, 1924, entitled "How the United States Can Meet Its Present and Future Pulp-Wood Requirements," the Department of Agriculture through Earl H. Clapp, Assistant Forester and Charles W. Boyce, Forest Examiner, in cooperation with the pulp and paper industry of the United States, has presented the findings of an inquiry into the pulp and paper situation in the United States.

The question of adequate present and future pulp-wood supplies is an important phase of the national timber supply problem, and the latter one of the most important problems now demanding solution. American forests today supply only 49 per cent of the pulp wood required in paper manufacture, whereas as late as 1899 they supplied 83 per cent. American forests are being cut much more rapidly than they are being replaced by growth, and the main reliance for fully meeting our pulp wood needs must be placed upon the growing of timber, as well as by making more complete use of our present available stock, by developing improved pulping processes.

Canada now furnishes the pulp wood for 37 per cent of our entire paper requirements, yet the Department of Agriculture states that the soils of the United States are better adapted to timber growing than those of Canada and other countries. In addition to this, of course, is the desirability of creating a permanent domestic pulp and paper industry which can meet our entire needs, founded on home-grown timber, thus doing away with the uncertainties and disadvantages attending dependence on foreign sources.

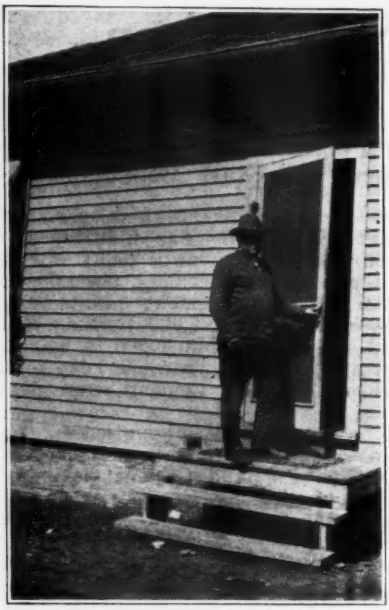
The Michigan State Prison Cement Plant

Leased for 5 Years from Michigan Portland Cement Company Convict Labor Now Producing Cement for State Consumption

MICHIGAN is one of the leading states in the production of Portland Cement, and each year its aggregate output assumes larger and more significant proportions. The first Portland Cement Company in Michigan, which was also the first in the country, was operated in 1872 by Bush and Patterson at Kalamazoo. Marl was utilized from a lake nearby. This company ceased operations about a year later, and nothing further was done in Michigan until 1897 when the Peerless Portland Cement Company constructed a plant at Union City. This plant has been in operation ever since. A year later the Michigan Portland Cement Company constructed two plants, one at Coldwater and another at Quincy, Illinois. In 1902 this company reorganized as the Wolverine Portland Cement Company. In 1899 the Peninsular Portland Cement Company organized and erected a plant at Cement City. This plant was the first cement plant in the world to be electrified. The New Egyptian Portland Cement Company was organized in 1901 and erected a plant at Fenton. The industry has continued to grow until today Michigan has nineteen cement plants. In 1923, Michigan cement plants employed more than 2,000 persons and paid out close to $4,000,000 in wages. During this same year 8,000,000 barrels of Portland Cement were produced.

The State of Michigan leased the plant at Chelsea, Michigan, from the Michigan Portland Cement Company for a period of five years with an option to purchase the plant. The state took over the plant in December, 1923, and is operating it under the same system used by the other state operated industries. Mr. L. L. Griffiths who was superintendent of the plant when operated by the Michigan Portland Cement Company was retained as superintendent of the state plant. Mr. Griffiths has a wide experience in the cement industry, and the State was fortunate in being able to secure a man of Mr. Griffiths' calibre and experience for such a new untried

Inside the Fence Looking at Office.

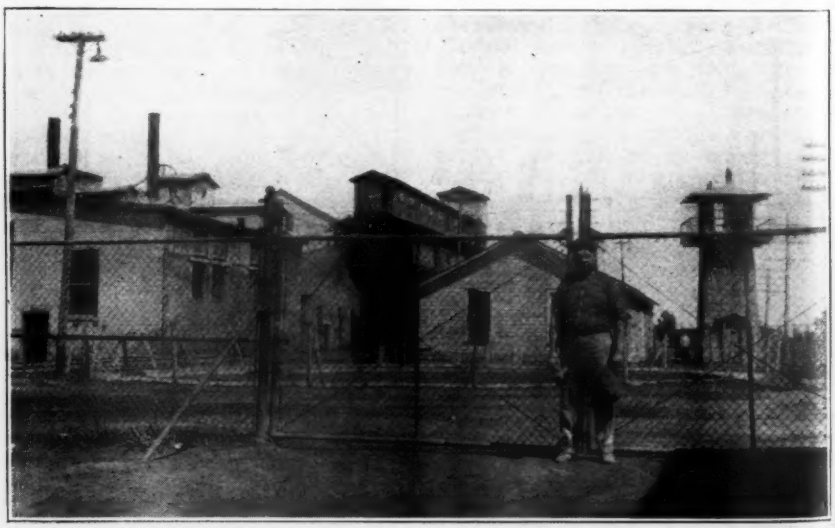


L. L. Griffiths Entering Office.

experiment as operating a state cement plant. Associated with Mr. Griffiths in this work are O. C. Brooks and his son L. L. Griffiths, Jr.

The cement plant, like all other state operated industries of Michigan, is under supervision of Warden Harry L. Hulbert who is responsible for any success the State of Michigan has attained in their institutional industries. He has a great responsibility and has shown unusual ability in the direction of the many different institutions. There are twenty-two of these institutions including furniture, soap, shoe, wagon, box, shirt, brick, and tile, overall, aluminum, textile, brush, canning, monument, and twine factories; ten farms, machine shop, saw mill, steel stamping plant, enameling plant and a cement plant.

Since March, 1924 the plant has been operated with 160 convicts and 30 foremen. The foremen are not convicts, but are men held over from the old organization. There is one foreman to each department. The convict labor, consisting of such state prisoners as Warden Hulbert selects to work at the cement plant, do all the labor in the operation of the plant. Mr. Griffiths has control of the discipline of the prisoners. Most of the convicts are serving long terms ranging from ten years to life. The plant is operated 24 hours a day everyday in the year except Labor Day. The prisoners work in two shifts of 12 hours each seven days a week. They are paid by a bonus system that permits their earnings to range from ten cents to $1.20 a day. This bonus operates on a sliding scale and increases with the production. A base rate has been set for each class of labor. The prisoners are permitted to spend $1.25 a week upon themselves, all other earnings



Outside the Fence. L. L. Griffiths, Jr. Note Elevated Guard House.

are either sent to their dependents or allowed to accrue until the day of release when the sum accumulated is turned over to the released prisoner. Since the plant has been producing up to capacity nearly every day, the prisoners have averaged $1.05 a day each. The prisoners are all well treated, and only occasionally has it been necessary to discipline any of them. This discipline ranges from certain restrictions to solitary confinement. The solitary confinement is in a cell without light but with plenty of air. This cell is equipped with a board bed and lavatory and is large enough to turn around in. The worst case would only necessitate three or four days confinement.

A well equipped hospital has been provided and careful medical attention is given all prisoners. There are two bunk houses, one for the day shift and one for the night shift. Both of these houses are airy and light. A "movie" theater has been built for the prisoners and many of the latest pictures are seen before their public release. A general store is operated for the convenience of the employees and prisoners. The Cyclone wire fence enclosing the plant, the seven elevated guard houses with their deputies armed with rifles, and the blue grey uniforms of the prisoners are factors that stamp the plant as a prison institution.

The prisoners are supplied with wholesome food of about the same quality as the average plant laborer is accustomed to. Outside the wire enclosure are fifteen bungalows for the deputy sheriff, guards and foremen.

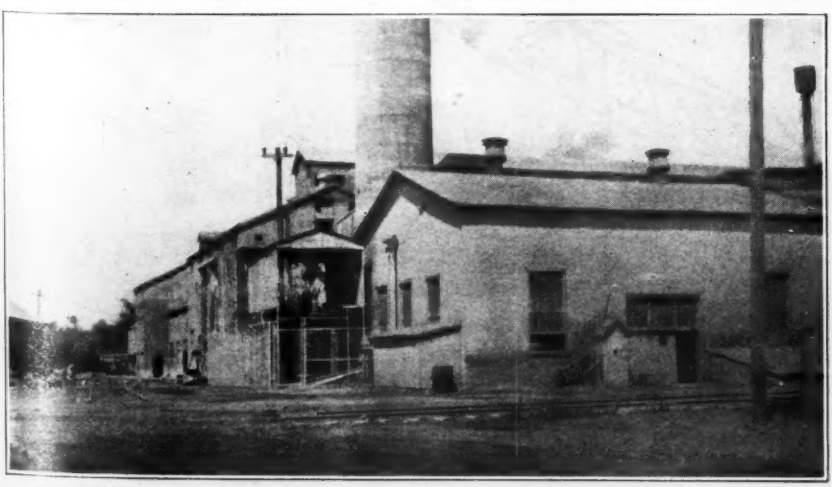
The plant was built by the Michigan Portland Cement Company in 1912 and remodeled in 1918. A record of the operations for the last few years may serve as a comparison with figures that will probably be available on the state operation later.

Year	1920	1921	1922	1923
Burn (Barrels Wet Process)	330,930	482,233	527,544	619,014
Days Operated	323	273	250	300
Grind (Bbls.)..	302,309	481,212	537,070	591,512
Shipped (Bbls.)	290,681	481,034	527,997	585,318
Average Gross Selling Price (Per Bbl.)....	$2.741	$1.884	$1.870	$1.963
Average Bulk Cost (Per BBl.)	$2.650	1.524	1.552	1.457

These results of 1921 through 1923 were effected during the superintendency of Mr. Griffiths and with the same machinery but a change in the method of burning. The plant has a daily capacity of 2,000 barrels. During March of this year the plant was up to 90 per cent capacity. During April it was up to 96 per cent and during May reached 100 per cent capacity and has practically maintained this percentage since. January and February of this year the plant was shut down. The production from March to September with the exception of June is as follows:

March	55,080 Barrels
April	57,407 Barrels
May	62,102 Barrels
June	Shut Down
July	61,508 Barrels
August	66,002 Barrels

A fire destroyed the packing house in June. This necessitated building a



Exterior View of Raw End and Power Plant.

new unit and so the plant was shut down. The new packing house is an all steel structure. The steel was furnished by the Wisconsin Bridge and Iron Works.

The property covers about 360 acres and about 60 acres are enclosed with a Cyclone wire fence. Clay is dug by a Lidgerwood dragline excavator and loaded into 5 cubic yard Oliver side dump cars and hauled by a Vulcan locomotive and dumped into a Smidth wash mill. A six inch Morris single stage centrifugal pump delivers it to three 18x22 foot concrete storage tanks.

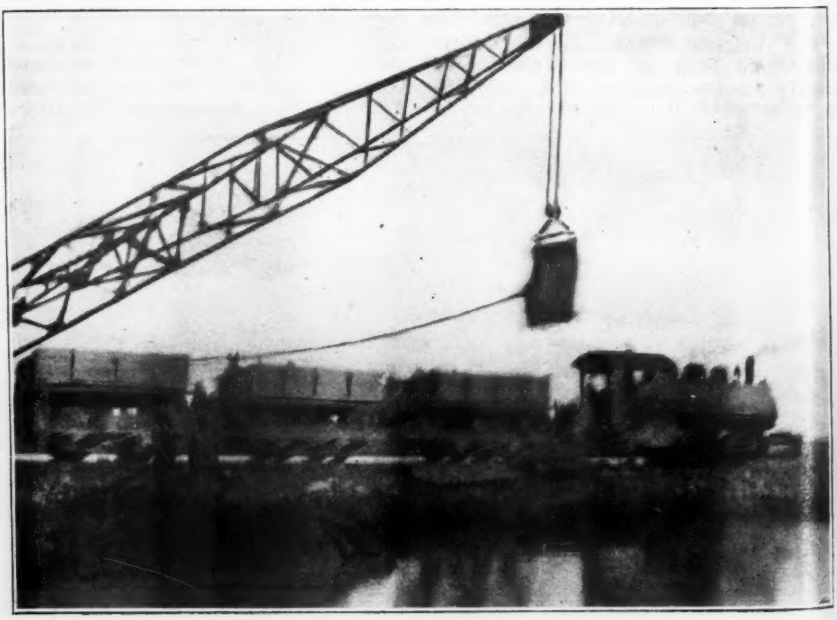
Stone is shipped from the plant of the Michigan Limestone and Chemical Company of Rogers City, Michigan. The stone when received is dumped into a track hopper and conveyed by an inclined belt conveyor 110 feet centers and discharged into feed bins directly over two Smidth kominuters or directly into storage bins of 100 tons capacity. This unloading is done during the day. The stone is drawn from storage at night by an 18 inch belt conveyor and distributed to bins over the kominuter mills. An Industrial crane is utilized to handle the outside accumulation of stone.

At the kominuters the clay and stone are mixed in the proper proportions. The clay is measured by planetary friction discs. The stone is fed by a hopper feed arrangement on the kominuters. After the material is mixed and granulated in the kominuters, it is discharged to two elevators and conveyed to two Smidth trix mills. The proper size is fed to three tube mills. Two are 5x20 Allis-Chalmers, and the third is a Smidth.

The slurry is discharged into a sump and picked up by a Morris 6 inch centrifugal pump and distributed to five 15x20 slurry tanks. These slurry tanks discharge into concrete ditches from which two 4 inch Morris centrifugal pumps discharge it into an elevated feed ditch at the feed end of the kilns where a bucket wheel feed is used to each kiln.

There is a counter on these feed wheels that registers the number of revolutions. These counters are connected with a duplicate set of counters in the laboratory. The output of the kilns is then checked back against these counter readings.

These three kilns discharge into concrete clinker pits which in turn discharge on to a Webster continuous pan conveyor that discharges into a 6x60 inch rotary cooler. From the cooler a Webster continuous belt conveyor 80 foot centers discharges the



Loading Clay ½ Mile from Mill.

material on to an 18 inch Sandvick steel belt conveyor 18 foot centers. This conveyor distributes the clinker to the clinker storage of 25,000 barrels capacity.

The clinker is reclaimed by means of a Webster tunneled belt conveyor 120 foot centers and discharged into a continuous bucket elevator 60 foot centers. The gypsum is mixed with the clinker at this point by means of an oscillating feeding device. The mixed clinker and gypsum are discharged into a rotary scale which in turn discharges onto a belt conveyor 60 foot centers and conveyed into feed bins over two 57 inch Fuller mills and two Sturtevant mills. The Fuller mills discharge into a common elevator which discharges into the tube mill feed bins. The Sturtevant mills discharge into two elevators discharging into Lamb screens The fines from the screen go to the rube mill bins and the rejects go back to the Sturtevant mills.

There are five 5x20 Allis Chalmers tube mills on the finish end. These discharge into a common conveyor which in turn discharges into a continuous bucket elevator 60 foot centers. This bucket elevator discharges to 14 inch screw conveyors which distribute the finished cement to the stock house of 54,000 barrels capacity.

The material is reclaimed from the stock house by four screw conveyors, discharges to two bucket elevators, and is delivered to packing bins of 500 barrel capacity over two 4 tube Bates packing machines and after packing is either loaded on cars or stored in a sack cement warehouse of 4,000 barrels capacity.

The cement is loaded directly on to cars when released if possible to save demurrage. Mr. Griffiths figures he has saved one day demurrage of every car resulting in a saving of $350 a month. Every barrel of cement is tested and approved by States Highway Department.

Coal is dumped into a track hopper and delivered by a Webster fan feeder to a Webster continuous bucket elevator 50 foot centers which distributes the coal to covered storage bins of 1,000 tons capacity.

The coal is reclaimed by a belt conveyor 120 foot centers underneath the bin and discharged to a Williams hammer mill. From the Williams mill a belt conveyor 50 foot centers discharges the coal to two feed bins over two 5x40 Ruggles Cole driers. These driers empty into a common continuous Webster bucket elevator which discharges into steel bins over four 33 inch Fuller mills. These mills discharge into a common 12 inch screw conveyor that discharges into a 60 inch Webster bucket elevator that delivers the pulverized coal to steel bins.

A six inch screw conveyor operated by a planetary friction disc drive delivers the pulverized coal to Sturtevant blowers. Each kiln has a number 7 Sturtevant blower.

The Excavator In Action.

The chemist makes a check analysis at the feed end and discharge end of the tube mills and at the slurry tanks as they are filled.

The power house is a brick structure. Four 250 H.P. Babcox and Wilcox boilers and two Hamilton Corliss engines drive two General Electric generators. For emergency purposes 25 per cent of the power necessary to operate the coal mill and kilns is generated. All motors are of General Electric manufacture.

The improvements made by the State since taking over the plant include the building of a new packing house; the purchase of duplex Westinghouse air compressor for agitating the slurry and clay; the installation of a Jeffrey Silent Chain drive for the 5th kiln, all kilns will probably be driven by silent chain in the near future; the installation of a new packing house conveyor manufactured by the Chain Belt Company; and the installation of Palmer Bee speed reducers for the screw conveyors and elevators in the new packing house.

This experiment of the State of Michigan will be observed with interest. South Dakota built a new plant while Michigan leased a plant on very favorable terms. Michigan is using convict labor while South Dakota does not plan to. South Dakota plans to enter the market in competition with commercial plants while Michigan only hopes to supply 25 to 30 per cent of her own needs. Michigan enters the field in place of a commercial plant while South Dakota enters as an additional plant.

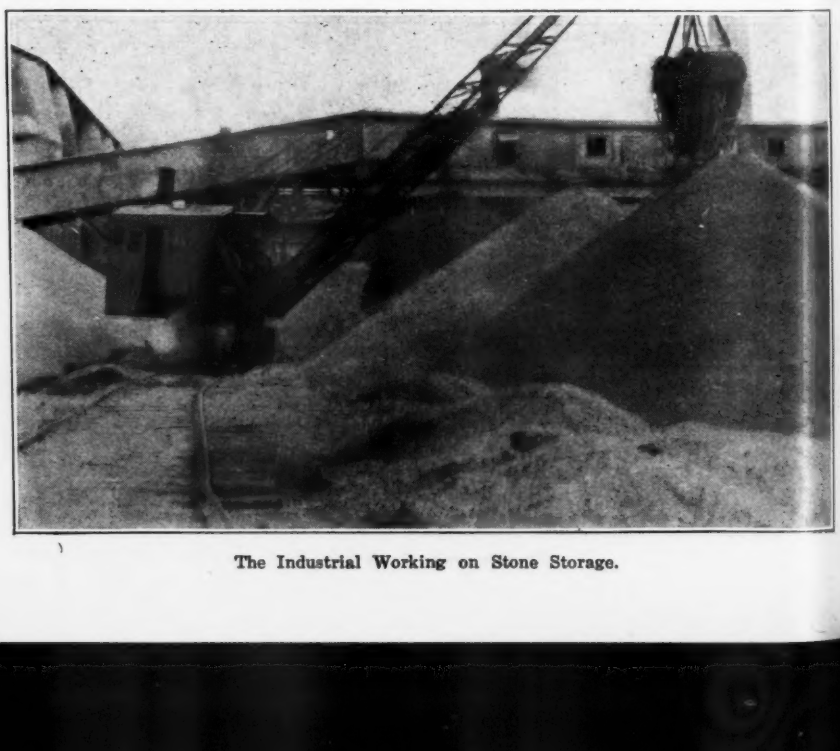
Shallcross Appointed General Manager American Lime Company

By action of the Board of Directors of the American Lime and Stone Company of Wilmington, Del., Samuel M. Shallcross has been appointed General Manager of the American Company. At the same meeting, Mr. Shallcross was made Vice-President and a member of the Board of Directors.

It was Mr. Shallcross' management of the business during the recent illness of Mr. Phillips, former general manager, that convinced the Board of his fitness for the position. Mr. Shallcross was formerly Treasurer of the company. Mr. Phillips resigned his position with this company to accept a position in a larger field.

Marquette Historical Sketch

"One Hundred Years of Portland Cement," by Bertrand C. Wheeler, just issued by the Marquette Cement Mfg. Co., of Chicago, is a 43-page illustrated pamphlet commemorating the centennial of Portland cement and the 25th anniversary of the Marquette Company.



The Industrial Working on Stone Storage.

Oil Engines in the Pit and Quarry Industries

By GEORGE B. MASSEY

As in every other industry, oil engines are finding a place more and more in pit and quarry equipment and plant. Taking for example a plant of two hundred horse power, the steam plant first cost would be from seventy-five to ninety dollars a horse power, the semi-Diesel oil engine plant sixty to seventy dollars, and the full Diesel plant from seventy to eighty-five dollars a horse power, so that the difference in first cost for a stationary installation is not great.

Thousands of horse power have been supplied by the oil engine builders for this purpose.

On excavating and transporting equipment, the well deserved popularity of the oil engine is increasing. Electric power purchased from the local source is perhaps more of a rival to the oil engine today than the steam plant.

In the consideration of purchasing electric power as opposed to oil engine installation there are several factors to be considered and the first is maximum demand. The maximum demand is the average kilowatts indicated during the thirty minute period during which the maximum current was being used. Or it may be taken over five minutes. In some cases a maximum demand is figured for each month. In others, the maximum demand is figured for each month. In others, the maximum occurring at any time during the life of the contract is used.

For quarry work, the maximum demand is from 50 to 55 per cent of the total motor installation. For instance, with an installation of 500 horse power in motors, the maximum demand will be 55 per cent of 500 horse power, or 275 horse power which equals 205 kilowatts. Or, in other words, the maximum demand in kilowatts is 41 per cent of the motor installation in horse power.

The second feature to be considered is load factor. This is the ratio of the number of kilowatt hours actually used during the month as indicated on the wattmeters to the number of kilowatts which would have been used if the maximum demand in kilowatts had been used all the time or 30⅓ days of 24 hours each, or 730 hours.

For example, if, with 300 horse power of motors installed, the energy charge for the month were 34,000 K.W.H., the load factor would be:
load factor = 34000 K.W.H.
$300 \times .55 \times 746 = 27.6$ per cent.

A stone quarry and crushing plant will have a load factor of 25 per cent in slack times and of 30 per cent running ful blast. There is also a monthly minimum charge usually based on the total horse power of all motors installed. Also a discount if current is not used during the late afternoon during the winter months. Quarries can and do usually take advantage of this discount, stopping everything but pumps.

All of the features discussed above are introduced to show what a variable the cost of electric power per K.W.H may be from month to month, and how hard it is in advance to settle on an exact average cost per K.W.H. for any extended period.

A steam plant would not show such variation but, in slack periods, steam would be kept up with almost the same expense as in rush times, and for running pumps a comparatively large steam plant would be in operation.

With the oil engine, more than with any other form of power, the cost per K.W.H. can be estimated very accurately and the fluctuation will be very little as the range of economical operation of a good oil engine is from half to full load and the use of fuel is almost directly proportional to the power generated.

The engine units can be such that one small unit can be used for pumping and one large one for running the plant under normal load, to be supplemented by the smaller one for putting through the maximum tonnage. This cuts down stand-by losses to the very minimum. There is this difference between steam plants and oil engine plants which is not always recognized. The small steam plant is extremely inefficient always. The large steam plant may be a very

efficient unit if equipped with all of the modern refinements.

When it comes to the small oil engine as compared with the large oil engine the difference in efficiency is very slight indeed.

It follows, therefore, that the smaller the installation, and the more irregular its use, the greater is the advantage to the oil engine.

In making any comparison between the advantages of the steam, the electric, or oil engine drive, the size of plant involved and its load factor must be the basis of the comparison or it is valueless. Oil engines may be classified as follows: Full Diesel engine using high cylinder pressures and with air pump direct connected to engine shaft for atomizing the oil injected into the cylinder by the fuel pump. The charge is fired by the heat of compression. They are built two cycle and four cycle.

Solid injection engines which have no air compressor. The charge is fired by the heat of compression. Built two cycle and four cycle.

Semi-Diesel engines which fire the charge by means of a heated bulb or plug in each cylinder. All two cycle. The full-Diesel and solid injection engines are usually built with a cross-head but there are examples of trunk pistons among the solid injection engines and the semi-Diesel are built both ways.

The standard Diesel engine fuel oil is 24-26 degree Baume' while the oil recommended for semi-Diesel engines is 36 degrees to 40 degrees Baume'.

The oil engine excavating machines are much more expensive than the steam excavating machine in first cost—from forty to fifty per cent.

The operating cost is much less. The oil can be obtained in most parts of the United States for seven cents a gallon or less.

Take for example a one-yard steam shovel on caterpillars as compared with a one yard full Diesel shovel on caterpillars.

	Steam	Diesel
First cost	$13,300	$19,000
Interest at 7% (per day for 200 day year)	$ 4.65	$ 6.65
Depreciation at 10% (per day for 200 day year)	6.65	9.50
Fuel, 20 gals. oil at 7c	....	1.40
Runner	10.00	10.00
Fireman	6.00	.....
Men on fuel and water lines	10.00	2.50
	$44.80	$30.05

Say fifteen dollars a day in favor of the full Diesel machine which would be $3,000 for a 200 day year and would pay for the extra first cost in less than two years. The saving would be greater if running two shifts.

As a matter of fact, the auxiliary service required for a steam machine as compared with that for a full Diesel machine is much greater than that indicated in the figures above including, as it should, camp expense, medical expense and liability insurance for several men which the full Diesel eliminates.

There is another feature to which every runner who has run both steam and full Diesel machines will testify, namely, that with the steam machine there is always a variable response of the machine when the levers are used. The boiler pressure may be low, the flues dirty or considerable condensation in the engine cylinders.

With the oil engine, the response is always the same, the engine being ready at each instant to give exactly the same amount of power in exactly the same way. This means increased yardage as has been proved by the writer's own experience on several machines. A runner on a full Diesel machine going back to a steam machine feels handicapped at once in his effort to turn out a good steady yardage.

The large revolving shovels which are used for overcasting overburden and for quarrying gravel and rock in the largest operations have not yet been equipped with any other form of drive than steam engines or electricity.

In the case of such large machines on large operations the probability is that electric machines will continue to be used, the electricity being generated on the property with oil engine drive. An electric cable for conveying the current to the machine is much more easily handled than a pipe line or tank wagon for the oil.

Oil engines of the size to drive these large machines is much better suited to a concrete foundation than the revolving frame of a large shovel.

Draglines of all sizes up to one hundred foot booms and three yard

buckets are being constructed and used with oil engine drives. Most of these are using vertical multiple cylinder semi-Diesel engines of the two-cycle type with friction gearing for operating the various machinery units. The horse power of these engines has a range of fifty to three hundred.

The usual arrangement is to locate the oil engine on the extreme rear end of the revolving frame so as to substitute the engine weight for the boiler weight on a steam machine as a counterweight to the boom.

The writer has designed a drive for draglines which places the oil engine across the machine just back of the machinery and with a large part of its weight either over the circle or immediately behind it. This reduces the destrictive vibration as the engine is not always at the overhanging end of the revolving frame. Of course the boiler weight must be replaced by oil tanks or circulating water tanks or some other form of counterweight so that the machine would be heavier than the steam machine.

In designing an oil engine drive for draglines, the engines should be placed across the machine if possible instead of lengthwise so as to obviate the use of bevel pinions as they are a constant source of delay and expense.

Vertical engines should be used in preference to horizontal and where there is a choice in the number of cylinders for any desired horse power, the greater number of cylinders will tend to keep down the vibration. Vibration, of course, is the fore-runner of crystallization and failure.

In the smaller sizes of shovels carrying ¾, 1 and 1¾ yd. dippers, and the corresponding sizes of draglines, one of the large builders is putting through, as a regular standard product, machines with a four cycle full Diesel engine. Heretofore, machines with oil engines were usually constructed after the order had been received which meant a serious delay in delivery. This is an excellent indication of the change in attitude toward the oil engine driven machine.

Up to the present time, the locomotives driven by internal combustion engines in this country use gasoline for fuel. In Europe there are small locomotives, and have been for years, which burn a heavy oil in a horizontal single cylinder engine with such a clutch and gearing installation as enables the locomotive to handle loads under all conditions of track and weather.

This is a logical development of internal combustion locomotives as the weight of the heavy oil is not at all objectionable and the wear and tear of high engine speed are reduced to a minimum.

Hydraulic and dipper dredges are being equipped or changed over with oil engines. The engines on the dipper dredges range from 75 horse power to 200 horse power, while on the hydraulic dredges the sizes for pit work seldom run over 250 horse power although for river work they run up to 1,000 horse power. In almost every case, vertical marine type engines are used—semi-Diesel up to 200 horse power and full Diesel above 100 horse power.

In the gypsum and phosphate fields oil engines are used in large numbers ranging from 100 horse power units to 500 horse power. One company alone has supplied 24 engines of a total of 8,000 horse power, or an average of 300 to 350 horse power per unit. Bucket ladder dredges for sand recovery are being operated by oil engines with marked success. They use 200 to 300 horse power units.

In purchasing oil engines, as with all other equipment, the price is a very good indication of the merits of the engine. The highest priced is usually the cheapest in the long run.

Link-Belt Changes

The Link-Belt Co. of Chicago, Ill., announces the following changes in organization as of July, 1924: Charles Piez, formerly president, is chairman of the board and chief executive officer; Alfred Kaufman, formerly second vice-president, was elected president; Staunton B. Peck, as senior vice-president, will direct and supervise operations and sales in the eastern district; Arthur C. Johnson, as second vice-president, remains in charge of operations and sales in the western district; Humphrey J. Kiely, third vice-president, continues in charge of exports and sales in New York district.

Catalog No. 29, containing 224 pages of information on Jones Gears, has been issued by the W. A. Jones Foundry & Machine Co. of Chicago, Ill.

THE BIRTH OF A NEW RAIL SYSTEM*

By JOSEPH H. DONNELL, Traffic Counselor LaSalle Extension University

A NEW railroad system to rank with the largest serving the Eastern territory of the United States is now in the making. Evolved by O. P. and M. J. Van Sweringen, of Cleveland, this system, embracing the New York, Chicago & St. Louis (Nickel Plate); the Chesapeake & Ohio; the Hocking Valley; Erie; and the Pere Marquette, totals over 9,000 miles of roadway, including leased and controlled lines.

A proposal submitted by the Van Sweringens for the unified control and operation of the five properties has been unanimously ratified by the directors of the roads and now awaits the formal approval of the shareholders.

Voluntary with each of the five carriers, this proposed grouping is popularly hailed as paving the way toward the realization along natural and logical lines of the principles of railway readjustments which the Transportation Act encourages. It will mark the first grouping to approach the size and scope of some of the larger systems contemplated in the broad recommendation of the Transportation Act for railway reorganizations, and outlined in the tentative plan promulgated by the Interstate Commerce Commission.

The present Nickel Plate, itself a consolidation of three carriers, merged by the Van Sweringen interests last year, is the nucleus for the proposed unified system, which provides three arteries in the country's main sweep of traffic from Western gateways, besides an outlet to the port of New York and routes giving direct access from Norfolk and Newport News to the veritable tip of the lower Michigan peninsula.

The system will have the shortest route between Buffalo and Chicago south of Lake Erie, the second shortest between New York and Chicago and between New York and Cleveland, and comparing favorably with distances to other points over other systems. Properties embracing more than 16,000 miles of tracks and sidings, representing an investment in road and equipment exceeding $1,081,000,000, are included.

Other states in which the constituent lines operate are New York, New Jersey, Pennsylvania, Illinois, and Virginia, beside the District of Columbia and the province of Ontario, Canada. The territory, generally, has shown marked increase in population and a consequent expansion of industrial and commercial activities during the last decade. The greatest mileage is in the state of Ohio, with Michigan a close second and Indiana third.

Important cities and centers reached by the system's own rails include the port of New York; Newport News; Norfolk, Va.; Richmond; Roanoke; Charleston, W. Va.; Louisville, Ky.; Chicago; Peoria; St. Louis; Detroit; Cleveland; Buffalo; Rochester; Erie; Youngstown; Akron; Columbus; Cincinnati; Toledo; Sandusky; Dayton; Indianapolis; and Fort Wayne, Ind.

The farthest point west is St. Louis, situated on the Nickel Plate; the most northern point, Bayview, Mich., on the Pere Marquette; and the farthest point south, Elkhorn City, Ky., on the C. & O.

The unification is declared to be shaped along lines that enhance facilities of transportation for established centers of production, distribution, and consumption. It adheres closely to natural trends of traffic, and especially serves the Great Lakes Region, the Pocahontas, and the Ohio-Indiana-Allegheny Region.

Mine products will constitute a large part of the tonnage of the integrated roads. The varied character of the territory served and the different local conditions and industrial factors insure diversified sources of income and kinds of traffic, including manufactures, products of forests, agriculture, and animals.

The new system is looked upon as capable of meeting requirements of its territory, equipped to give a good account of itself with relation to trunk line rivalries, and able to assist the transportation situation generally with relation to service for American industry. In this connection, it is pointed out by railroad authorities that Van Sweringen control of the Nickel Plate, C. & O., and Hocking has been marked by a program of progressive improvements involving the expenditure of many millions of dollars for additions and betterments.

*From an article of the same title in the October number of the Trade and Transportation Bulletin.

Model Gravel and Concrete Products Plant Completed in Michigan

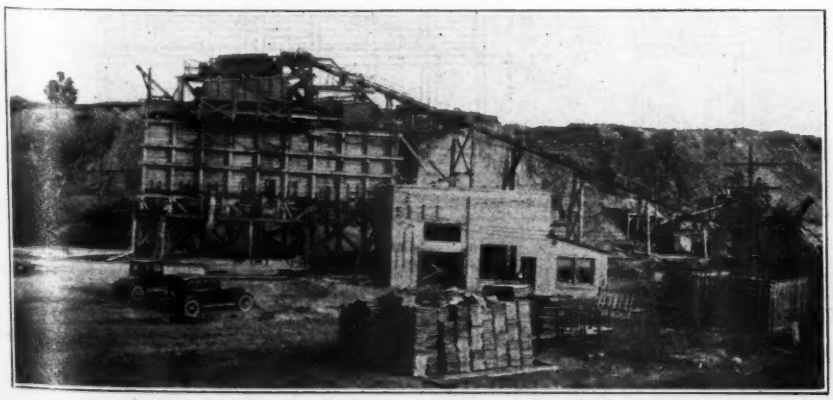
Acme Concrete Products and Gravel Company of Cement City. Now Producing Daily 1,000 Tons of Gravel and 6,000 Concrete Units

BOTH the sand and gravel and the concrete products industries of Michigan have gained a prestige within the last decade that places them among the highly specialized and standardized industries of the state. It remained for the World War, which brought unheard of activity in the building trades, to bring these industries into their own. Mechanical invention which has continued without abatement facilitated and speeded up production and made possible a greater output at a considerably lower cost.

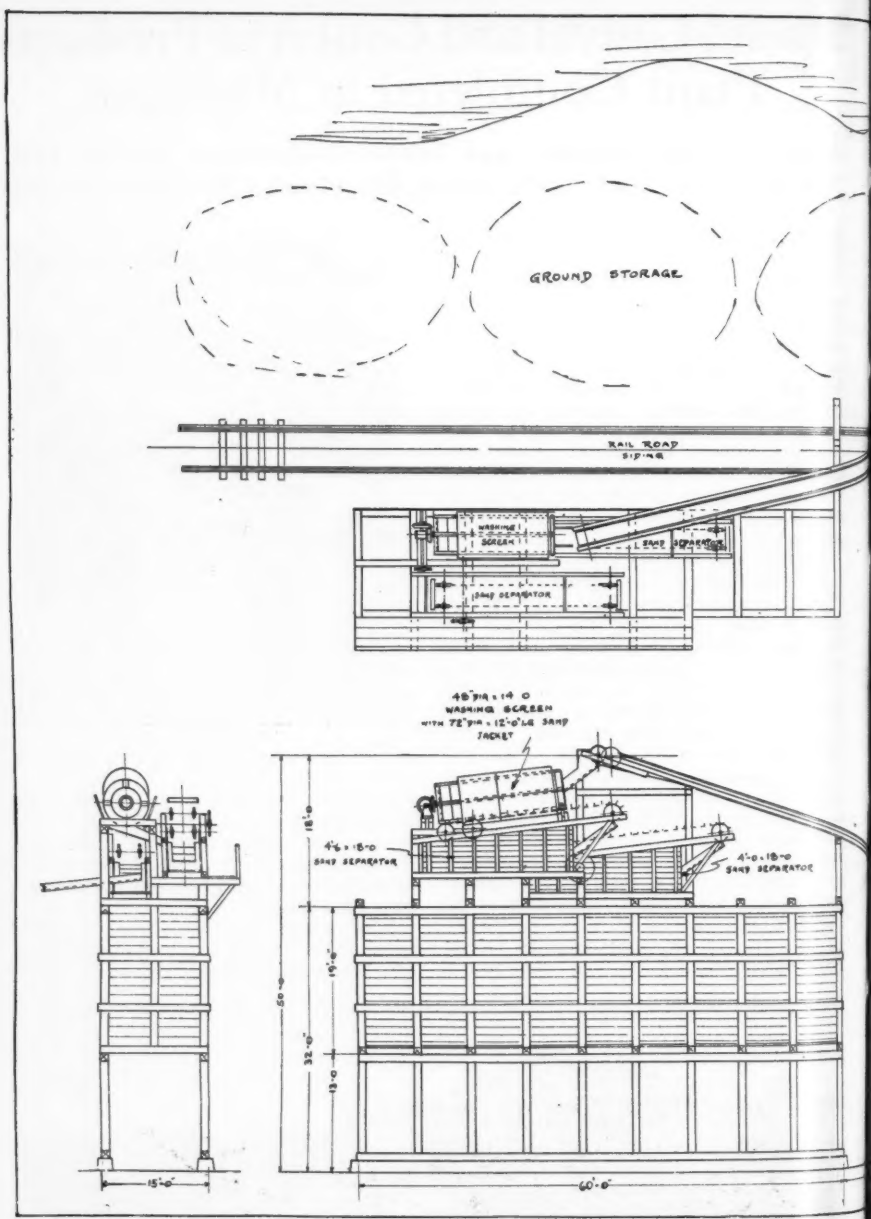
During the fall of 1923, a party of the directors of the Acme Concrete Products and Gravel Company undertook a trip of inspection among established plants in Illinois and Wisconsin with a view to securing the experience of others in the matter of machinery, methods and sales. Early in the spring of this year, Mr. E. W. Dienhart was made General Manager of the company. Mr. Dienhart supervised the construction of the plant and will be in charge of operations. Formerly he was on the staff of the Portland Cement Association where he earned quite a reputation among concrete products manufacturers through his extensive speaking tours on the subject "Making Quality Products Economically." The six years that Mr. Dienhart spent with the Portland Cement Association in research and investigation work particularly qualify him to complete and operate a model gravel and concrete products plant.

J. R. Bakstad and E. W. Dienhart.

The plant is located at Cement City, Mich., on the Cincinnati Northern Railroad. The Peninsular Port-

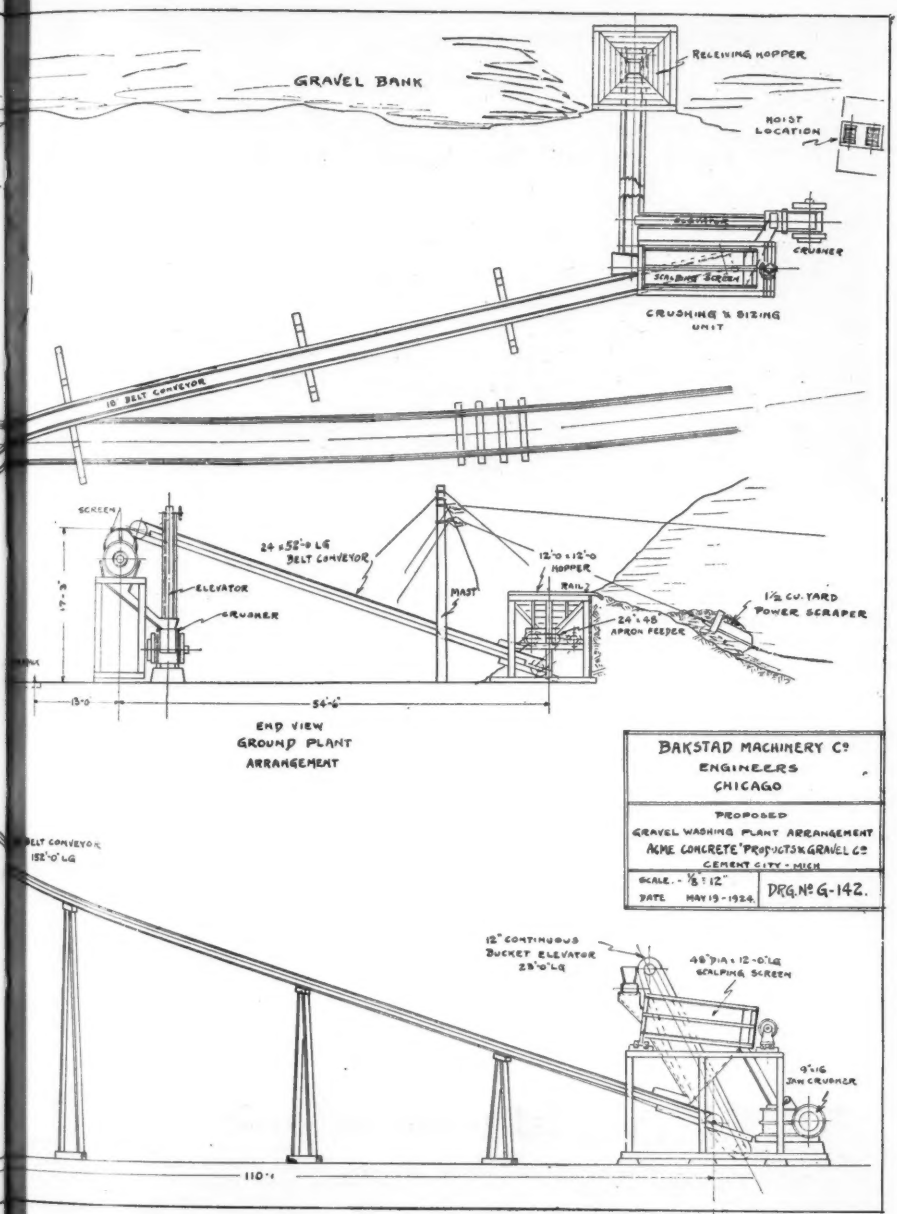


A General View Showing Concrete Products Plant in Foreground.



land Cement plant is only a short distance away so the cement can be trucked right to the plant.

The deposit covers about 75 acres of excellent sand and gravel running 60 per cent sand. The bank being worked is about 50 feet high. Most of the sand and fine gravel produced will be used in the manufacture of concrete tile and blocks. The gravel and surplus sand will be washed, graded and shipped. The plant has a capacity of 1,000 tons of gravel and 6,000 concrete units a day. The Cincinnati Northern Railroad connects with the New York Central.. There



is a side track at the plant capable of carrying 25 to 30 cars.

The stripping is done with a Type B Erie steam shovel and a ¾ yard dipper and loaded into 4 yard Western dump cars drawn by a 14 ton Vulcan steam locomotive.

The plant is arranged for crushing and separating all oversize gravel in a ground plant unit permitting only the material prepared for the washing plant to proceed to the washers on top of the bins. The hoist operator practically controls operations from his platform. He has a full view of every moving unit. The clutch for

A View of the Deposit Showing Dragline.

cutting out the receiving hopper, feeder and initial belt conveyor is under his control. The main conveyor and washing plant on top of the bins can also be stopped from the lower plant.

A Sauerman power scraper with a 1½ yard Crescent bucket operated by a Clyde special belted hoist with a 75 H. P. General Electric motor brings the sand and gravel from the pit to a 12 cubic yard receiving hopper located at the foot of the bank. A special 24x48 inch roller chain apron feeder delivers the material from the hopper in an even flow to a 24-inch initial belt conveyor 52 feet long equipped with oil-less rollers. The hopper and conveyor have been designed for extension into the pit when the first setting of the scraper has excavated beyond its reach.

The material is conveyed to a 48x60 inch semi-roller Reliance revolving screen perforated with 2 inch holes. The material passing the screen goes to an 18 inch 152 foot belt conveyor and then to another Reliance washing screen. This screen is also a Reliance semi-roller revolving screen 48 inches in diameter and 14 feet long with 1 inch perforations. It is equipped with a woven wire jacket 72 inches in diameter and 12 feet long. The first 8 feet of this jacket is ¼ inch mesh and the balance is ⅝ inch mesh.

All oversize from the first screen passes to a 9x16 inch Austin jaw crusher. The crushed gravel is ele-

View Showing Incline to Screens.

vated by a continuous bucket elevator to the discharge point of the initial conveyor. This crusher was part of the company equipment before this plant was designed.

The screen is equipped with spray nozzles both inside and outside and baffle plates have been added to the screen. This arrangement produces a well washed product. The feed spout from the conveyors to the screen, is also provided with spray nozzles and designed to act as a scrubber.

The material passing the screens is in three sizes, ¼ to ⅝ inch, ⅝ to 1 inch and 1 to 2 inch. The residue which is sand and dirty water passing the ¼ inch screen is directed into a Bamaco sand separator. This separator is 4½x18 feet. This residue which contains all particles finer than ¼ inch and all the dirty water enters the wash box on one side. The flow of material into the separator and the action of the steel flights attached to the endless chain keep the material in the separator in constant agitation. The clay is held in suspension in the wash box and the clean sand particles fall to the bottom of the separator where they are picked up by the steel flights and carried out of the separator and dropped into a bin.

By regulating the height of the baffle boards at the overflow end of the separator, the fineness of the particles of aggregate can be controlled by raising or lowering the height of the baffle boards. The higher the baffle boards the finer the material will be.

There are two Bamaco sand separators. After the material passes the first separator the residue is passed to the second separator where the material goes through the same process, but a much finer graded product results because all the coarse particles are extracted in the first separator. The product from the first separator is suitable for concrete sand while the product from the second separator is suitable for mason sand, plaster and engine sand.

This system of sand separation is positive in action and affords a simple means of controlling the grading of sand particles.

Water is furnished by a 6 inch belt driven American centrifugal pump operated by a 30 H. P. General Electric motor. This pump is located at the foot of the plant where a steel well casing 5 feet in diameter has been sunk to a depth of about 20 feet.

The bins are divided into compartments to accommodate the particular sizes of material. The aggregate for the concrete products plant is drawn by conveyors from one side of the bins while railroad cars are loaded from the opposite side. Truck loading is handled directly under the bins.

Ground storage is handled through flumes with a small amount of water and will be loaded in cars by the Erie shovel.

All conveying and transmission belting is special Bamaco brand furnished by the Bakstad Machinery Company of Chicago.

Electric power is secured from the Consumers Power Company of Jackson, Mich., and is 3 phase, 60 cycle, 440 volt, alternating current. The various units are grouped to simplify

View of Plant Showing Hoist House to Right.

operation. All motors are General Electric and grouped as follows:

	H. P. Motor
Power scraper hoist	One 75
Feeder, initial conveyor, screen, crusher and elevator	One 35
Main Conveyor	One 10
Washing screen and sand separators	One 25
Pump	One 30
Concrete Products plant	One 20

The aggregate for the concrete products plant is delivered by a belt conveyor to a hopper over a Blystone mixer, and then to either of two Besser single automatic block machines or an Anchor high test automatic tile machine. The plant building is constructed of tile made on the Anchor machine. The production of the concrete products plant will be brought up to 6,000 units a day. The concrete units are being made convenient to a curing room where a temperature of about 100 degrees is maintained. Curing is from 24 to 48 hours depending largely upon weather conditions. Plenty of storage space is provided by a space of 75x250 feet paved with concrete. The Anchor machine was furnished by the Anchor Concrete Machinery Company of Columbus, Ohio. This machine permits the use of an extremely wet mixture. All the concrete receives a direct blow from the tamper. The block is stripped out of the mold box. This mold box is bolted rigidly insuring an absolutely true block.

Mr. Dienhart with his knowledge and experience will be able to turn out a quality product economically. Advantage has been taken of an excellent manufacturing process and properly graded aggregates, long time mix, correct ratio and proper curing and handling will be observed.

The large volume of production with the low manufacturing costs that Mr. Dienhart expects will enable him to reach a wide market.

The Bakstad Machinery Company of Chicago designed and equipped the plant after a careful study of the conditions and requirements necessary to balance the production and minimize the operating costs. Mr. Dienhart is well pleased with his new plant and states that the plant went together exactly as Mr. Bakstad's, head of the Bakstad Machinery Company, plans and designs called for. Mr. Bakstad also spent considerable time assisting Mr. Dienhart in the actual construction of the plant.

The contract with the Bakstad Machinery Company was closed on July 1st of this year and the plant was in operation September 10th. The Bakstad Machinery Company furnished the plans for construction work and assembly and supplied all the machinery except the dragline outfit and motors. The plant went into operation on September 10th without a hitch and shipments have been made daily since. A production of 15 to 20 cars for a 10 hour day will be the average but 20 cars a day can easily be maintained if necessary.

View of Plant from Operator's Platform.

Effects of Lime on Shale Retorting*

By CORWINE S. DAVIS

AMERICAN engineers, geologists, and other scientific men have warned us of the imminent exhaustion of the crude oil supply. The peak of American production is thought to have been reached, while the quantity demanded by the users of refined mineral oil products is swelling at an increasing rate and promises to run rampant in the near future. Scientists have long been awake to the need of a new source of motor fuel and lubricating oil. Alcohol from vegetation is limited even if it is developed to the utmost, and coal tar benzene is not inexhaustible; so we fall back upon the mountains of our western states which are built up of a quantity of oil shale sufficient to yield ten times as much crude oil as has been consumed by the world.

Much acknowledgment is due the Scotch pathfinders of industrial shale retorting, for throughout the seventy years of operation, only during the last decade has the industry been considered a success. The industry in Scotland has been handicapped because the raw shale is found in subterranean strata, but it can successfully compete with petroleum products because of the higher selling prices in that country.

The immediate future of an American shale industry would be marked by keen competition with the petroleum industry. Except for isolated markets such as ore flotation, ore dressing, sheep dip, and shale soap, the shale oil refineries must compete with the petroleum products in providing an outlet. Considering the impurities present in the two, namely: sulphur, nitrogen, oxygen, aromatic and unsaturated compounds, shale oil is comparable only to the lowest grades of petroleum. While the refining losses of the challenger may in many instances be as high as 25%, the losses in petroleum refining do not exceed 7% when alternately acid and base are used. The presence of these compounds gives to shale oil its objectionable odor and color deepening qualities and also the ability to form gums on standing.

The manipulation of the retorting operation and the control of the physical effects seem to be the key to the successful production of a low priced shale oil, because the nature of the products obtained can be greatly varied by slight alterations such as rate of heating, local overheating, steam as opposed to dry distillation, removal of vapors, etc.

In the simple fractionation of petroleum those proportions of naphtha, gas oil, lubricating oil, and residuum are obtained which are originally present in the crude oil. The demand for motor spirit so far exceeds that for the other products that other means than simple fractionation are resorted to, and the skimming plant is being operated in order to make industrial fuel oil available at an economical price.

Gasoline has been supplied somewhat by casinghead and the product removed from natural gas. Another source of gasoline is from the operation known as "Pyrogensis" or cracking which is the process of suddenly cooling hydrocarbons at a high temperature in the vapor phase under pressure, causing them to fall back into the hot zone and forming permanent gas, coke, and oil of lower specific gravity containing a considerably larger proportion of unsaturated compounds.

Oil shale is predominantly inorganic mineral substance having imbeded within its closely compressed layers the more valuable bituminous substance. The name kerogen has been generally accepted to define this bituminous material in shale which upon destructive distillation is converted into oil, gas, ammonia, and coke. An agreement concerning the chemistry of kerogen is sought by organic chemists and is demanded by the shale industry, because a technically successful retort to be designed upon scientific principles must have for its basis of design the knowledge of the behavior of this peculiar substance during destructive distillation.

Scientists recognize the existence of two geologically distinct forms of shale oil. One, according to theory, was formed by absorption of the petroleum that was filtered through the mineral substances in shale; the

*From a thesis presented by Mr. Davis at the University of Cincinnati.

other was brought about by the decay of the animal remains and was retained by absorption by the mineral substances. Examples of the first are the Devonian shales of Scotland and those of Kentucky, Ohio, and Indiana. Examples of the second are the shales of the highlands of the Great Divide of North America.

Sulphur, nitrogen, unsaturated and aromatic compounds filter through porous substances less readily than do oils of a paraffin structure. Paraffin hydrocarbons can be fractionated by forcing them through a tower of fuller's earth and extracting the oil at various points along the tower, the tower boiling compounds passing through more readily. This supports the theory of the formation of Pennsylvania oil. When western petroleum is filtered through fuller's earth, the product is similar to eastern oil.

An analogy between shale and porous clay after the filtering action is complete is that in neither case can the oil be removed by washing or solvent action to anywhere near completion. Less than 2% of the bituminous material in shale is soluble in organic solvents and Gilpin and Bransky only succeeded in removing approximately 50% of the combined oil from the freshly prepared product. Undoubtedly the explanation is to be sought in the colloidal absorption by the argillaceous mineral substance, because destructive distillation is necessary to remove the absorbed oil.

Another point of similarity between shale and such porous substances as fuller's earth and kieselguhr is that the chemical analysis of the one reminds one of the others. The lime content of several samples of Kentucky Devonian shale is as follows:

County	CaO Percent
Lincoln	0.67
Bullit	1.29
Lewis	1.63
Elliot	0.80
Estill	1.37
Webster	0.81

In 1882 David Urquhart procured a patent granting to him the exclusive right to add to oil shale in retorting, lime or other substances containing an alkali or alkaline earth metal to increase the yield of ammonia. He states that the presence of lime also tends to purify the retorted oil by retaining within the shale a considerable quantity of the sulphur and rendering the oil more free from nitrogen. No further theoretical work was recorded concerning the nature of the oil obtained. This apparent negligence on his part may be explained by the fact that the substance sought primarily in Scotland was ammonium sulphate, and oil was only a by-product. He stated that the action of lime was more pronounced when slaked and in a damp condition.

Crutchfield found that lime increases the yield of ammonia from coal in a low temperature carbonization. He also states that the quantity of paraffins obtained when lime was added was greater than before, but their boiling points were higher.

The explanation of the low saturation of shale oil according to Botkin lies in the fact that there is an insufficient quantity of hydrogen present to produce saturated oils. He determined the ratio of hydrogen to carbon for a paraffin oil of a gravity corresponding to an average shale oil and found it to be 1-5.6, while the ratio of hydrogen to carbon determined in shale oils from various localities varied from 1-6 to 1-8. This explains why if olefines are formed along with the paraffins, much free carbon remains in the shale. Other compounds have been added to shale when retorting and the subsequent chemical and physical effects were noted.

Gypsum-oil and ammonial yields were increased but the action was attributed to the water of crystallization in the gypsum, because an equal quantity of water produced the same phenomena when injected as superheated steam.

In summarizing the foregoing theoretical section of this subject we remember that kerogen is an undetermined substance absorbed in the pores of an argillaceous colloidal material, and that this kerogen was formed by selective absorption of the constituents of petroleum other than paraffin hydrocarbons, probably altering in its nature throughout the ages. We have seen that the spent shales contain little calcium and that lime added to a colloidal substance causes it to lose this property and to disintegrate.

Again, we pointed out that lime added to shale in the retorting operation increases the yield of ammonia and that lime added to coal in retorting at low temperatures increases the yield of ammonia and also increases the saturation of the tar oils.

The object of this thesis is to determine the effect upon the quantity and the saturation of the oil obtained when lime is added to oil shale in the retorting operation.

The apparatus used was as follows:

RETORT—15 inch wrought iron pipe, 4 inch diameter with cap at one end and blank and flange joint plates at the other. Copper gasket (7 inch disc). ⅜ inch delivery pipe

GAS BURNERS—Three Fletcher evaporating

THERMOMETER—Brown recording, oil expansion

AIR CONDENSER—1000 cc filter flask

NAPHTHA RECEIVER—500 cc filter flask

AMMONIA SCRUBBER—700 cc filter flask

WATER CONDENSER—Liebig

MANOMETER—Mercury, glass tube

GASOMETERS—Gasholder 33.25 li. working capacity; half carboy 9.0 li. working capacity

HEMPEL GAS ANALYSIS APPARATUS—

Burrette and leveling tube
Two single pipettes (2 bulb)
Three double pipettes (4 bulb)
Explosion pipette, mercury leveling tube and induction coil

SATURATION TEST APPARATUS

Four Babcock cream test bottles
Centrifuge, hand propelled

The factors which we would expect to be varied by the presence of lime would be the quantities and compositions of the gas and oil and the quantity of ammonia. It was only the first two products which were handled in this investigation as Urquhart showed that lime does cause the ammonia yield to be increased.

The non-condensable gas was analyzed, taking samples below 425° and 500° and above 500°, using the standard Hempel Gas Apparatus and the technical methods described in Treadwell-Hall "Quantitative Analysis" and "White Gas and Fuel Analysis."

The saturation test of the oil (the per cent of volume not attacked by conc. sulphuric acid) was conducted as described by Botkin. It was found to be necessary to distill the crude oil and to determine the saturation of the distillate because of the extremely dark color and opacity of the crude oil. Care was exercised to make certain that the conditions of distillation were identical in all of the comparative tests, because it is well understood that different modes of distillation of a crude shale oil will alter its saturation.

In the construction of the retort, considerable care was required to see that all joints were tight because a pressure of 8 inches of mercury developed during the distillation from the back pressure caused by the static head existing in the gasometer. The bolts of the blank and flange plates had to be drawn very tight. A $\frac{1}{16}$ inch copper gasket was found to furnish the most satisfactory joint.

The shale was subjected to the same rate of heating throughout the series of experiments, because it was the object to make the results comparable. The time or retorting was limited to three hours duraton because the operator must be present during the entire procedure to manipulate the apparatus. This made it necessary to heat the shale very rapidly by opening wide the gas cocks of all the burners and as is shown by the thermometer charts, the various runs received practically identical rates of heating.

Distillations were made with shale alone, 5% quicklime plus 50 gms. water, 10% quicklime plus 100 gms. water, and 20% quicklime with no added water. The gas was led alternately into the carboy and gas holder, one being refilled with water while the other was collecting gas.

RETORTING DATA

Charge	Gas li.	Oil cc	Sat. %
2.5 Kg. Shale....	87.5	52	.65
2.5 Kg. Shale....	90.5	53	.60
2.5 Kg. Shale 5% lime 50 gm. water	72.0	68	.40
2.5 Kg. Shale 10% lime 100 gm. water ...	55.0	72	.33
2.5 Kg. Shale 20% lime	84.0	66	.46

GAS ANALYSIS—Shale Alone

	Below 425°	425°-500°	Above 500°
Carbon dioxide...	13.8	19.4	24.0
Illuminants	3.5	2.4	1.2
Oxygen	0.5	0.3	2.3
Carbon monoxide.	2.4	5.4	9.9
Hydrogen	12.3	20.2	27.7
Methane, Ethane, etc.	64.5	51.7	26.8
Nitrogen	3.0	0.6	8.1

SHALE ANALYSIS

Silica	36.32%
Alumina	11.60%
Iron oxide	2.00%
Titanium oxide	0.40%

Calcium oxide	5.72%
Magnesium oxide	3.82%
Sulphur	2.01%
Potassium oxide	2.91%
Sodium oxide	1.30%
Ammonia	1.21%
Loss on Distillation	32.71%

Moisture—1.40%
(35 gm. water / 2.5 Kg. shale)
Kjeldahl Nitrogen

Raw Shale	.72 and .75%
Spent Shale	.094%

The results of the experimental work show that the presence of lime in the retorting of oil shale exerts a decisive effect upon the oil and permanent gas obtained. By observing the graphical representation of the data at the conclusion of this manuscript we see that an increase in the quantity of lime added causes an increase in the quantity of oil, a decrease in its saturation and a decrease in the quantity of gas.

While performing this work the writer was led to believe that the action of lime was due to a reversal of the slaking equation and that the liberated water caused the observed phenomena, which is parallel to the apparent catalytic action of gypsum with shale. Later it was learned that the Bureau of Mines uses gypsum to produce an atmosphere of superheated steam in the destructive distillation operation.

A further indication that the action due to the water formed is the result of a study of the thermal dissociation of slacked lime. No decomposition occurs at 100°. At 400°, 30% of the possible water is expelled and at 450° nearly all of the water may be driven off. It is generally accepted that the oil is generated from kerogen at about 400-450° C and McKee claims that kerogen decomposes into a solid bitumen and the oil is subsequently formed from it at a quite definite temperature of 400-410° C, so the water is liberated by the lime as superheated steam at just the temperature where it is most effective.

An excess of lime over a chemically equivalent quantity of water appears to be practically ineffective because there is no water, to be split off as superheated steam. Either 5% of lime or 10% of lime with excess of water are each more effective than is 20% of lime with a limited quantity of water. The 35 gm. of water present as moisture is equivalent to approximately 100 gm. of lime in the slaking equation and this weight of lime represents 4% of the charge of shale. This explains just why this one experiment with 20% of lime (4% effective lime) was less active than the 5% and 10% runs. We assume of course that the slaking action begins at 100° when all water present as such will be free to combine with the lime and any excess of water over the chemical equivalent for the quantity of lime present will be lost at 100°.

Because of faith in the theories of collodial chemistry the writer is still prone to believe that the lime itself is instrumental to a small extent. The results of the experimental part of this thesis are the same as in commercial practice where superheated steam is used to sweep the oil vapors out of the hot zone, yielding more oil but of lower saturation than if the vapors had remained longer in contact with the hot retort to cause them to crack, producing a lesser quantity of more saturated oil and more gas.

A comparison of gas analyses from distillations with and without lime would lead to no definite conclusions because investigators have shown that the analysis of the permanent gas is not altered essentially when steam is employed. This leads one to believe that the pyrogenesis in the initial formation of oil is of the same nature as a secondary cracking.

The writer would like to offer here an explanation of the increased amount of ammonia obtained when lime is present, besides the action of the steam. Ammonia, mono, di and trimethyl pyridine and kerogen are known to be decidedly basic. When ammonia is once formed, the presence in the realm of reaction of a basic substance such as lime would displace the ammonia from the zone of reaction similar to the effect of adding more of a common ion to a near saturated solution and causing precipitation. Urquhart very likely had this idea in mind when he performed this work, but no record except his patent right could be found relating to his work.

It would be interesting to determine the relative merits of lime and gypsum to be used to generate superheated steam in a shale retort. Apparently lime would be more advantageous because the steam is liberated at just the temperature desired, while gypsum loses most of its water of hydration at 107° C.

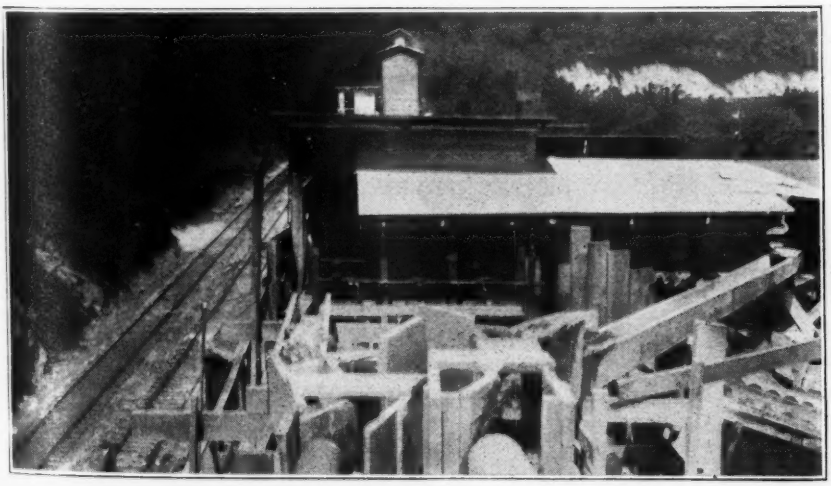
The Maryland Glass Sand Company Operates Interesting Plant

Unusual Deposit Located on Plateau 900 feet Above River. Water Needed Pumped From Potomac River Up Mountain

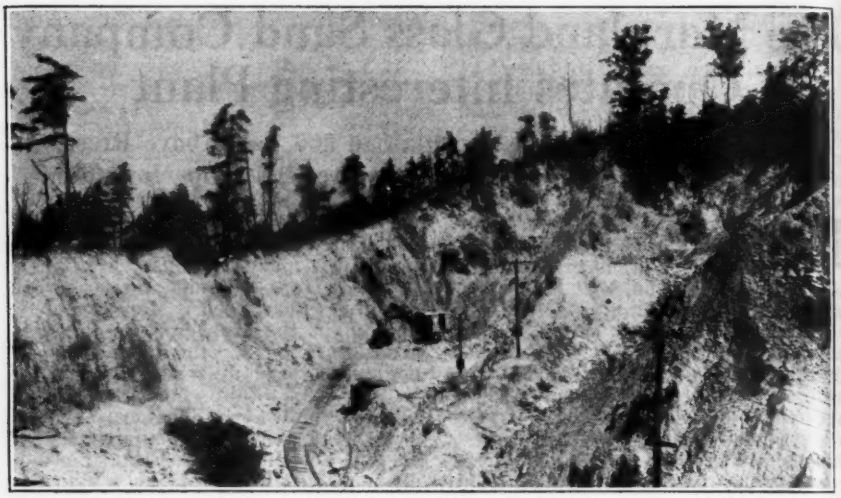
THE Maryland Glass Sand Company with offices in Hagerstown, Maryland, has a plant at Round Top, Maryland, that is not only unusual but interesting.

The plant is located on the W. M. R. R. at a point where the Potomac River, C. & O. Canal and railroad run through a valley less than a half mile wide. The deposit is a very unusual one being located on a plateau which is the top of a conical mountain 900 feet above the Potomac River. The deposit is soft enough that it can be handled by a Marion model 21 electric shovel with practically no blasting. However, there are quite a number of boulders mixed through the deposit some of which have to be broken with dynamite. The sand is loaded with the Marion shovel into five yard gable bottom Koppel dump cars which are hauled to the mill with a four ton Whitcomb Locomotive, a distance of 800 feet. The cars are pulled over a storage bin of 500 tons capacity with a 45 degree angle bottom which is connected to the mouth of a 12x16 inch Blake type crusher set at 2½ inches. At the mouth of the crusher there is a one inch stream of water constantly running on the sand in the bin which makes it slide very freely into the crusher making it work under a choke feed. More water is applied in the crusher jaws to avoid crushed material sticking in the 45 degree angle chute which delivers into a 9 foot Phillips-McLaren Chaser mill or mull pan. The crusher and chaser mill both have a capacity of 50 tons an hour. In the mull pan additional water is applied making a sand solution which is flushed through perforated material into revolving screens 8 feet in diameter with a 30 inch face. The oversize taken out by these screens is returned to the mull pan by gravity making a closed circuit at two discharge points.

The material passing the mesh of the wire is concentrated into an 8 inch terra cotta flume line 2900 feet long carrying the sand in the water which has been applied in crusher and mull pan to the railroad at which point the stream is divided four ways into four sets of (three each) washing screws. The overflow of screws is run into settling bins where the water is allowed to rise three feet in

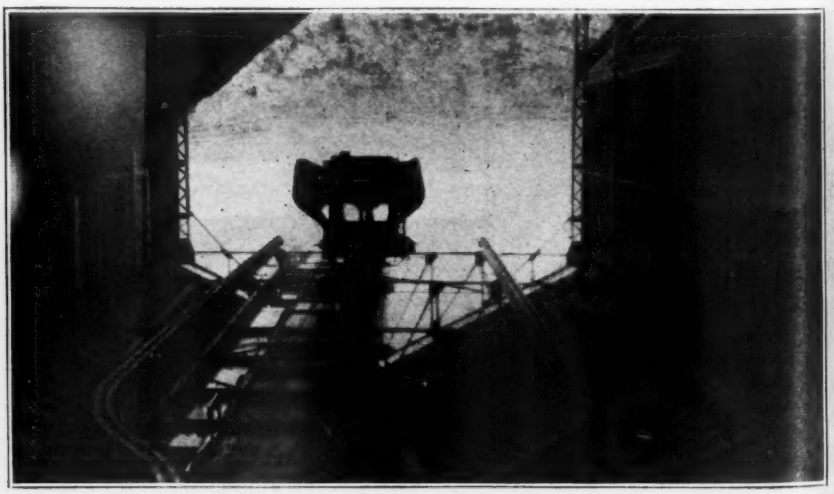


Washing, Loading and Drying Plant.

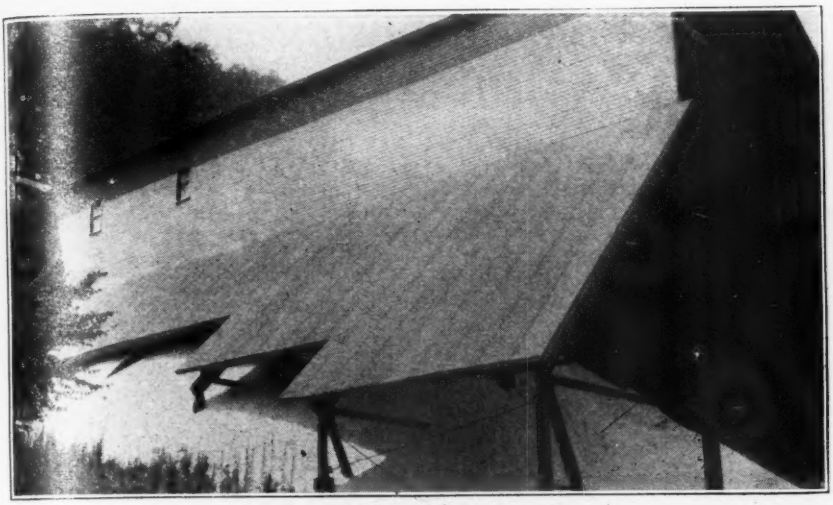


A View of the Quarry.

which all sand of value settles. The loam and finer material spilling over is carried by pipe into the Potomac River. The sand accumulated in the settling bin is used exclusively for building and foundry purposes. The sand separated by washing screws passes from one screw to the other, fresh water being applied between each screw and the screws are on thirty degree angles. The third screw deposits the sand on a conveyor belt running on the top of a large steel building which is used for washed sand storage having a capacity of 20,000 tons. The sand is scrapped off of conveyor belt at five different points. After damp sand is deposited in storage, it is recovered for drying by means of a Shepherd Monti-Rail hoist with a one yard Hayward clam shell bucket, and is taken from the oldest pile in storage from which the water is leeched until the sand does not contain more than ten per cent moisture. The dryer hopper has the capacity of 70 tons of leeched sand as stated above containing ten per cent moisture. The dryer is steam coil type 5 feet wide



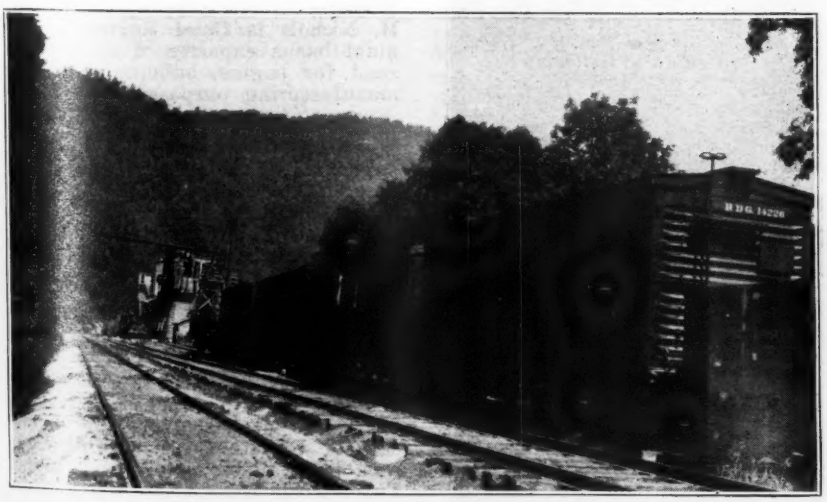
Reclaiming Dump Sand.



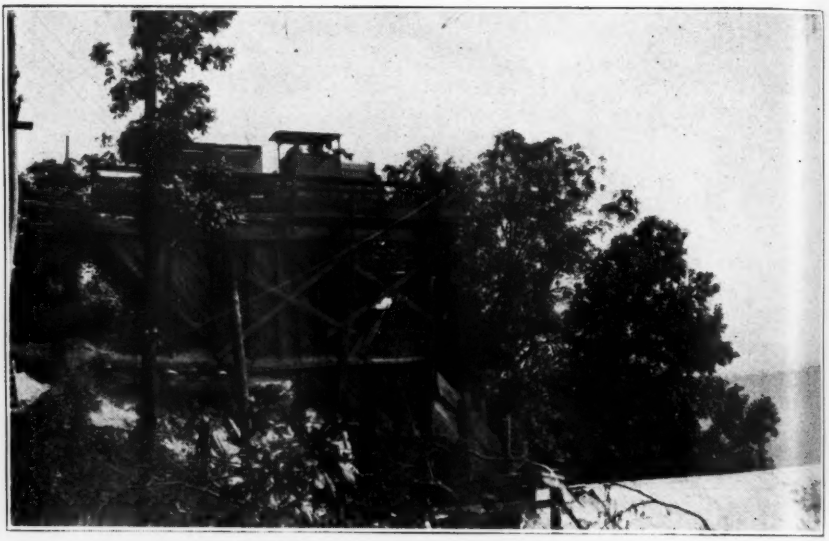
Damp Sand Storage.

by 60 feet long filled with a series of 1½ inch pipe connected by manifolds at each end. This dryer was manufactured by the Lewistown Foundry and Machine Company of Lewistown, Pa. The water from condensation drains to one point where an automatic Worthington boiler feed pump returns it to the boiler which is a 100 H. P. Erie return tube type. Only 500 gallons of fresh water are required each 24 hours. The boiler is operated at 100 pounds steam pressure.

The sand with ten per cent moisture is supported by the top row of steam pipes, but since the steam is applied to these pipes the sand, of course, begins to dry working its way down through the steam pipes where it is concentrated on a belt conveyor. The two bottom rows of pipes have spaces of ¼ inch through which no sand will pass until thoroughly dry. The dry sand is then elevated to a height of 75 feet where it is screened through 26 mesh wire into storage bins from which it is loaded by



View Showing Flume Cross.



Unloading at Crusher Storage.

gravity into paper lined box cars. A portable belt conveyor is used in the car to distribute the sand.

The water for the operation is pumped from the Potomac River to the top of the mountain by two Aldrich 7-inch Triplex pumps having a capacity of 300 gallons per minute each driven by 100 H. P. motors, pumping through six-inch pipe lines, each 4,000 feet long, making a total head including friction of 915 feet.

There are approximately 600 feet of 20-inch 5-ply Goodyear conveyor belt used in the plant which has given excellent service.

Mr. H. H. Jennings is General Manager of the company and Mr. E. H. Nichols is Chief Engineer. The plant has a capacity of 500 tons of sand for engine, building and glass manufacturing purposes.

Pipeline Up to Plant.

Tuberculosis Xmas Seal Sale

The aid of all industrial and business interests are solicited for a united effort to reduce further the high death rate from tuberculosis in the United States by the National Tuberculosis Association. What is needed in this direction is education of the public in the nature of tuberculosis and the proper methods of combating it.

In order to educate 100,000,000 people, funds are needed. These funds are derived from the annual sale of Christmas seals, which will soon be available from the National Tuberculosis Association, whose headquarters are 370 Seventh Avenue, New York City.

Cost Accounting in the Crushed Stone Industry

III

Written expressly for PIT and QUARRY by D. J. HUTCHINSON

THIS is the third of a series of articles on this subject, the first of which appeared in the September number and the second in the October 1st number of Pit and Quarry. The first article discussed accounting in its relation to selling prices, the application of uniform accounting methods and material as an element of cost. The second article discussed expense analysis and distribution while this article covers the principles and basis of expense distribution. Readers are invited to submit particular questions relating to cost methods to Mr. Hutchinson, care of Pit and Quarry.—Editor.

IN THE second article we divided the cost of crushed stone into the cost of the stone in the ground and the cost of conversion, the latter comprising all of the expenses, including labor incurred in the process of removing the stone from the ground and preparing it for use. We found that the conversion costs are obtained by allocating the total expenses incurred in the course of production to the several productive operations or processes on account of which they were incurred. These operations or processes we have termed departments, and the allocation of expenses we have found consists in distributing the natural classification of expenses, representing the items purchased over the departmental classification representing the successive steps in production.

Principles of Expense Distribution

The general method of expense distribution was illustrated by the Chart of Expense Accounts (figure 1) accompanying the second article. It is now necessary to consider the particular basis of distribution that will apply to each item of expense. In each instance there is one underlying principle which should be observed whatever method or basis of distribution is adopted.

This principle is that wherever possible expenses should be charged directly to the productive operation (department) responsible for the expenditure, leaving for distribution on an arbitrary basis only such items as can not be applied directly.

It was formerly the practice in cost accounting to apply with great exactness the so-called direct elements of cost—direct labor and direct material

D. J. Hutchinson.

—lumping the residue into a single item called overhead or burden, which was then distributed on some arbitrary basis. But this element of overhead constitutes too large a part of the total cost of production to deserve such casual treatment, which loses sight of one of the principal purposes of cost accounting, namely to furnish a means of controlling and reducing costs.

Obviously it is impossible to control total costs. The only thing that can be controlled is the detail item, and through controlling each of these the total takes care of itself. From this standpoint it is essential to retain in the cost records as much detail as possible regarding each item of expense, and to refrain from gathering together under one head unrelated items that have to be applied on an arbirary basis.

Just how far this principle of the direct distribution of expenses can be carried varies to some extent with respect to the different items of ex-

pense. It depends a good deal on local operating conditions as well. But in general whatever items of expense can be charged directly to the operations on account of which they were incurred should be so charged, and only items that can not be handled in this manner should be charged to the Indirect Departments and redistributed.

Distribution of Departmental Expenses

Operating Labor is the first Departmental Expense Account and it is perhaps the simplest item to distribute as the charge is made direct to the department in which the labor is employed exclusively in one or another of the operating departments to which the time is directly chargeable, as determined by the time reports. Where employees are shifted from one department to another it is, of course, necessary to indicate such changes on the time reports and to give effect to them in the labor distribution. Forms of time reports and labor distribution records will be given when we come to consider the various books of original entry where the first record of departmental expenses is made.

One exception to the direct distribution of operating labor must be made, however, in the case of the Floating Gang. These are employees that are shifted as a group from one department to another wherever needed so frequently that as a matter of clerical routine it is not practicable to give effect to these changes by the ordinary methods of pay roll distribution. Therefore, provision is made for charging the wages of these employees to a fictitious department called the Floating Gang. To this same department are charged all other expenses of the Floating Gang in addition to wages, as liability insurance, supplies such as small tools, etc., used by these employees, first aid and welfare expense, etc. All of the expenses of the Floating Gang are then redistributed as will be seen when we take up the Distributed Charges.

The second labor account is Repair Labor, which for obvious reasons it is important to keep separate from operating labor. However, in most quarries the repair labor is usually performed by the same men that perform the operating labor, most of whom make at least the minor repairs on their own equipment. Under these circumstances the same methods of distribution will apply that are used in distributing the operating labor, but the time reports will necessarily show whether the labor is repair or operating. In larger plants where a repair crew is maintained it should be handled as a separate department in the same manner as the floating gang.

In addition to operating and repair labor there are two other labor classifications that are not properly a part of the cost of production, but that must be provided for in distributing the total pay roll. These classifications are Renewals and Replacements and New Construction.

The distinction between Renewals and Replacements and Ordinary Repairs is a very important one although not always easy to make. Strictly speaking, Repairs refers only to the minor day to day repairs which serve to keep the machinery in ordinary running condition, and these are chargeable to operating expense. It is only labor and material used in repairs of this kind that is to be charged to the Repair Labor and Repair Material expense accounts.

Major repairs on the other hand that involve replacements or rebuilding of important parts of the machinery or equipment tending thereby to "restore it to its former condition and materially prolong its life" are classed as Renewals and Replacements. Such renewals and replacements are not an operating expense but are to be charged to the depreciation reserve, since the operating charge was made in the form of depreciation. Obviously to again charge such items to operations would result in a double charge leading to an understatement of both income and asset values.

Similarly labor on new construction work must be carefully kept out of asset values. The dangers of not doing so are illustrated by the case of a sand and gravel company which the writer visited a few months ago to make an examination in the interests of certain investment bankers who had been asked to underwrite a bond issue on the property. The books showed that no distinction had ever been made from the time the company started about six years ago between construction costs and operating costs. As a result, the plant values were very much understated and the operations "per books" showed a loss each year. The opera-

tions undoubtedly had in fact been profitable, and would have appeared so if the books had been kept on a proper basis and the proper distinction observed between operating and construction costs. However, from the very meager records available it was impossible to reconstruct the accounts so as to show the property values and the earnings necessary to justify the loan.

Hence it is very important to keep out of the operating accounts the labor and material used in new construction work or in the installation of new machinery, as these items are properly chargable to the asset account as part of the cost of the property acquired.

There are two more labor items in the natural classification of expenses represented by the accounts Foremen and Supervision, and Clerks and Timekeepers. The distribution of these items depends almost altogether on local conditions and particularly on the size of the plant. In the quarry of average size the time of these employees is spread pretty generally over the entire plant, and it must therefore be charged to the General Plant Department. Wherever there are foremen, clerks, etc., whose time is employed exclusively in one or another operating department, however, it should be charged to that department. In the Chart of Expense Accounts we have assumed the average condition under which these items are charged to the general plant department.

In addition to the above actual labor items, there are two other accounts, Liability Insurance and First Aid and Welfare, representing expense items that result directly from the employment of labor and that should, therefore, be distributed on the labor basis.

Liability insurance premiums are ordinarily paid annually in advance on the basis of the estimated pay roll for the year, and adjusted at the end of the year in accordance with the actual pay roll. When the premiums are paid they are charged to a deferred expense account called "Prepaid Liability Insurance." This item is then taken into costs by a monthly entry crediting the deferred expense account and charging the departmental expense accounts an amount determined by applying the premium rate to the total departmental labor cost. At the end of the year the balance in the Prepaid Liability Insurance account representing the under or over absorbed premium will be the amount of adjustment due to or from the insurance company.

Since First Aid and Welfare is essentially a labor expense, it is proper that this item also should be distributed on the basis of the departmental pay rolls. It is necessary, therefore, to determine the departmental pay rolls, that is to distribute all of the labor accounts, before distributing either the Liability Insurance or First Aid and Welfare expenses. The former is then distributed by applying the premium rate to the total departmental pay roll. Under this method new construction and renewals and replacements will also bear a proper proportion of the liability insurance expense. First Aid and Welfare is distributed on the basis of the percentage ratio each departmental pay roll bears to the total pay roll.

Supplies, whether for operations or repairs, should, like labor, be charged as far as possible directly to the departments in which they are used. Certain supplies that are purchased for immediate use, or that are of such small value as not to be worth inventorying, can be charged directly to the departmental expense accounts at the time they are purchased. Other supplies that are purchased in quantities for future use must be charged to the supply inventory accounts and requisitioned out as used. The requisition will show the department for which the material is needed, and also whether for operations or repairs, or for new construction, etc. A monthly summary of the material requisitions will then furnish the basis of the departmental charges.

The departmental expense account covering Miscellaneous Expenses represents items that for the most part are chargeable to the General Factory department. Wherever these items can be charged directly to the operating departments, however, they should be so charged.

Distribution of Fixed Charges

The fixed charges, Depreciation, Insurance and Taxes are all based on property values. The basis of distribution is, thereore, the same in each case, the value of the fixed assets employed in each department.

As a practical matter, however, particularly in older plants, it is often very difficult to establish the departmental property values where the plant accounts have not been kept on

a departmental basis. Usually the plant accounts are grouped under such headings as "Real Estate and Buildings," "Machinery and Equipment," etc., without any distinction being observed in the accounts as to the departments in which the property is located and used. Moreover, it is often an almost impossible task to analyze this information out of the property accounts so as to reconstruct them on a proper departmental basis.

Under these conditions, an appraisal is the only method of setting up the property accounts.

The best method of handling the property accounts is by means of a plant ledger in which there is an account assigned to each machine or other important asset. By this means the proper rate of depreciation can be applied to each asset and the charge for such depreciation made to the proper department. Where plant accounts are grouped without regard to the departments in which the property is used and with assets taking widely varying rates of depreciation included in one account, it is impossible to determine what the proper depreciation is, or to what operation or department it is chargeable. It is then necessary to fall back on a general depreciation rate averaged over the entire property and charged to General Plant expense. The more scientific method is to maintain a plant ledger so that the proper rate of depreciation can be applied to each asset, and each department can be charged with the depreciation on the property it employs.

No exact rules can be laid down as to what the proper rates of depreciation are since they are influenced by many variable factors, such as the number of hours per day, and days per year, the equipment as used, the amount spent on repairs, whether the equipment is used at normal capacity or consistently overloaded, etc. Some approximation, however, to the average depreciation of quarry equipment is given in the following table:

	Per Cent
Belting	5
Boilers	6-8
Buckets, excavating	20
Cables, haulage	50
Cars, quarry	25
Chimneys	7
Crushers	12½
Fans, ventilating	7½
Furniture, office	10
Locomotive, quarry	8
Motors, electric	12½
Power plant equipment	7½
Rails	12½
Transmission equipment, shafting, pulleys, etc.	8
Shovels—	
Electric	10
Gasoline	18
Steam	12½

We have noted that the cost of production of crushed stone consists of the cost of the stone in the ground plus the cost of extracting it and preparing it for use, or material cost and conversion cost.

The material cost, whether appearing as depletion or royalty, is based on the quantity of stone removed and is readily obtained by applying the depletion or royalty rate to the number of cubic yards produced. Moreover, it is but a small part of the total cost.

Cost accounting in the crushed stone industry is, therefore, primarily concerned with the conversion costs. These, we have seen, consist of the total expenses incurred in the course of production, including the amounts paid for labor, and the cost accounting problem is primarily one of applying these expenses to the productive operations so as to show the cost of each.

Some of these expenses were applied directly to the productive operations represented by the several Direct Departments in accordance with the methods of distribution already discussed. Other expenses, however, could not be attributed to any one productive operation, and were accumulated in Indirect Departments. It remains, therefore, to redistribute the Indirect Department expenses to the several Direct Departments in order to obtain the total costs of operating the latter.

Indirect Operating Departments

In distributing the Indirect Department costs to the Direct Departments the same principle of direct application that governed the distribution of the departmental expenses should be observed as far as possible, and arbirary distribution should be resorted to only where no direct basis can be established.

Following this principle we find that certain of the Indirect Departments really represent productive operations carried on in two or more direct departments. The cost of such operations should be distributed on

the basis of the extent to which they are carried on in each direct department. Let us consider the application of this principle of distribution to the first of the Indirect Departments—the Shovel.

The expense of operating the shovels represents a true operating or production cost, and not an overhead. These operating costs we have divided between the successive productive operations, stripping, drilling, blasting, etc. From the practical operating standpoint, however, it often happens that the same shovel equipment and labor is used intermittently in more than one productive operation. From the practical accounting standpoint it is difficult under these operating conditions to apply the expenses of the shovel directly to the productive operations on which it is engaged from time to time. Hence, we adopt the method of accumulating the total cost of operating shovels as a distinct unit, redistributing this total as a "Distributed Charge" to the several operating departments employing the shovels.

The basis of this redistribution is the proportionate use by each direct department. The data from which this is determined is best obtained from the time reports. The shovel operator, therefore, will report his time according to the Direct Department in which the shovel is employed, as stripping, stock-piling, etc. This information will not be used to distribute the shovel operator's time alone, as that will be charged to the Shovel Department in making the pay roll distribution. It will, however, be combined with the reports of all other shovel operators to furnish a basis for distributing the total shovel department costs.

This method of redistribution is not entirely one of expediency. While it is necessary to meet the operating conditions in smaller plants where separate equipment is not maintained in each department, it is of positive value also in giving information as to the cost of shovel operation. For this reason the method may properly be used even in larger plants where the use of distinct equipment in the several operating departments makes redistribution unnecessary from the standpoint of practical accounting procedure. Although the total costs of production are to be accumulated on the basis of the successive productive operations represented by the Direct Departments, it is still useful to know the separate cost of auxiliary operations such as steam shovel operation.

With the exception of the General Plant, the other Indirect Departments are of the same nature as the shovel department. That is, they represent actual productive operations carried on in more than one Direct Department. Thus the second Indirect Department, Trucks, represents costs that are accumulated and redistributed to the Direct Departments on the basis of the time the trucks are employed in each, in the same manner as was outlined for handling the shovel costs.

The Power Department is found, of course, only in quarries operating their own power plant. Quarries purchasing power will be able to charge the item as a departmental expense directly to the department for which the power is purchased. In either case the basis of distribution is the same, that of power consumption. The most accurate way of determining this is of course by the use of separate meters in each department. Where meters have not been installed, however, the same distribution can be approximated by comparing the rated horse-power capacity of the equipment employed in each department. Also data can be obtained from the manufacturers as to the power consumption of their equipment per hour of operation, from which tables can be prepared furnishing a basis for power distribution.

The Floating Gang represents a group of employees that are shifted as a group from one operating department to another. The foreman's time report will, therefore, furnish the basis for distributing this item.

General Plant Department

The General Plant, however, differs from the other Indirect Departments in several important respects. In the first place, as has been noted, each of the other Indirect Departments represents certain items that from the standpoint of practical accounting procedure it is more convenient to accumulate separately and redistribute to the productive operations, but that none the less constitute in themselves true operating or production costs rather than overhead or burden items. The General Plant expenses, on the other hand, are of the latter nature. To this department are charged the salaries of superintendents, foremen, clerks and

miscellaneous employees such as watchmen and timekeepers, as well as the other miscellaneous expenses connected with the operation and maintenance of the plant as a whole. These are items which we are accustomed to consider as plant overhead or burden, and for the distribution of which some arbitrary basis must be determined.

In determining such an arbitrary basis of distribution we must be guided by the nature of the various items of expense. In analyzing the General Plant expenses from this standpoint, we find that they are of three kinds: those which come about from the employment of labor, those which are due to the use of property, and miscellaneous expenses.

The miscellaneous expenses cannot be attributed to any one general cause and, furthermore, they are relatively small in amount. They may be disregarded, therefore, in determining the basis of distributing the General Plant expenses.

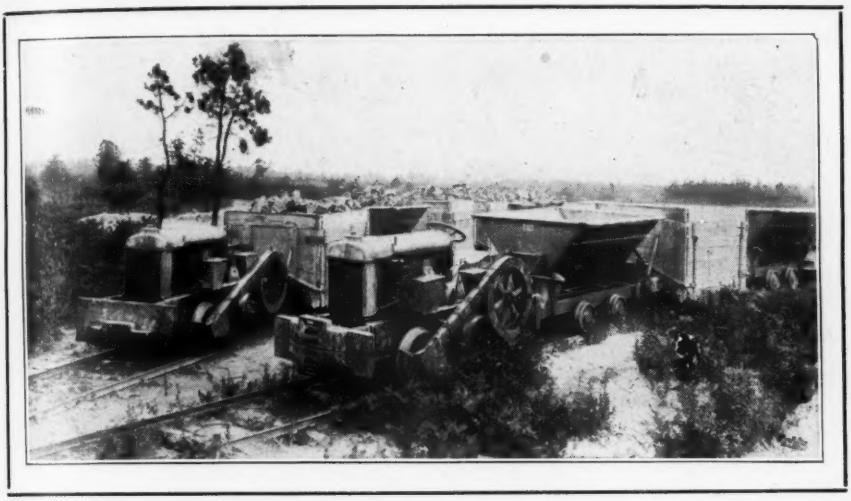
The expenses due to the use of property are the fixed charges—depreciation, insurance, and taxes. As pointed out in an earlier article, these items should be distributed directly to the Direct Departments wherever the data relative to the value of the property used in these departments is sufficient to establish such a basis of distribution. It is only when such data is not available, due to improper or incomplete classification of the property accounts that these items should be charged to the General Plant Department. Under these circumstances we obviously cannot look to these items for a basis for distributing the General Plant expenses, since if such a basis existed it would be applied to these items directly.

This leaves the items of expense that come about through the employment of labor. These items are the salaries and wages of superintendents, foremen, timekeepers, etc., expense items that arise from and are directly due to the employment of labor. Hence, the labor basis is the basis on which they should be distributed. Moreover, it is the operating labor alone, without the repair labor, that should be taken for this basis. The amount of repair labor in each department depends on accidents and contingencies more or less beyond control and varies widely from time to time. It is the operating labor that measures the relative importance of each department from the standpoint of the amount of supervisory labor required. The General Plant expenses are, therefore, to be distributed on the basis of the operating labor employed in each department.

This method of distributing the General Plant expenses, it will be seen, involves one serious inconsistency where the fixed charges are included. In that case the fixed charges which arise from the use of property are distributed on the basis of the employment of labor. If the employment of labor and the use of the property in the several departments were even approximately proportionate, this inconsistency would not be serious. But the contrary is the case, since the employment of more expensive machinery tends to decrease rather than to increase the proportionate labor charge. Therefore, the items of cost represented by the fixed charges cannot be distributed properly except on the basis of property values. Hence, the plant ledger and a proper departmental classification of the property accounts discussed in the preceding article are of great importance if accurate departmental costs are to be obtained.

In distributing the Indirect Department costs, it will be noted that a certain sequence must be observed in the order in which these departments are closed out, since certain of the Indirect Departments serve other Indirect Departments as well as the Direct Departments. Thus the General Plant Department, which represents the "overhead" items that are distributable to all of the Indirect Departments as well as the Direct Departments, must be closed out first, in order to obtain the total expenses of the remaining Indirect Departments, which must include the General Plant Department charge.

The second Indirect Department to be distributed is the Floating Gang, a portion of whose time may be chargeable to the Shovel and Truck Departments. Similarly, the Power Department may serve the shovels when these are electrically operated, and the power costs must, therefore, be distributed before the shovel costs are complete. The Shovel and Truck Departments are then the last to be distributed to the Direct Departments. In the next article we will illustrate the methods of expense analysis and distribution discussed in this and the preceding articles.



Duplicate Evidence
of
Brookville Service

In 1922 the United Clay Mines Corp. purchased two of the first twelve Fordson Brookville Locomotives manufactured. Since that time both locomotives have been in constant service handling loads from 15 to 20 tons, with a maximum grade of 2% against loads. Every alternate trip is made in reverse.

Though the Fordson power plants in these machines may have required repairs, the Brookville Locomotives proper have required no repairs whatever. And the Brookville Locomotive that you buy today is at least a 50% improvement over these machines.

Behind the power plant of the Brookville—the Fordson Unit—lies the greatest manufacturing plant in the country with a nation-wide repair service. Behind the completed Brookville Locomotive lies six years of experience and study in manufacturing gas locomotives using the Ford power unit.

It will pay you to consult us regarding your haulage problems. We may be able to show you a definite saving with the Brookville.

The Brookville is a complete Locomotive—not an attachment

Brookville Truck & Tractor Company
BROOKVILLE, PA., U. S. A.

BROOKVILLE
GASOLINE LOCOMOTIVES

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PHENS-ADAMSON
MFG. CO.
URORA, ILLINOIS

You Are Paying for a Brownhoist

Then Why Not Own It?

A letter will bring you catalogs and complete information showing you how to cut material handling costs.

If you are still handling materials by the man-and-wheel-barrow method you spend thousands of dollars a year that could be used to purchase a crane. The chances are that the money a Brownhoist would save every year over manual labor costs would more than cover the cost of its installation. Why not own the Brownhoist you are paying for this year and count next year's saving as extra profits?

Contractors, railroads, material dealers, sand and gravel operators, road builders and scores of others have found these machines reliable, efficient and economical. Equipped with a clamshell, hook or magnet, Brownhoist cranes handle anything from sand to iron and steel scrap.

The Brown Hoisting Machinery Co.
Cleveland, Ohio

Branch Offices: New York, Chicago, Pittsburgh, San Francisco, New Orleans, London, England

BROWNHOIST

MATERIAL HANDLING MACHINERY

Illinois Crushed Stone Company Builds New Plant

Anna Stone Company Completing New Plant at Anna, Illinois. Capacity Increased to 3,500 Tons Daily—Electrically Driven.

THE property of the Anna Stone Company is located at Anna, Union County, Illinois, on the main line of the Illinois Central Railroad running from Chicago to New Orleans.

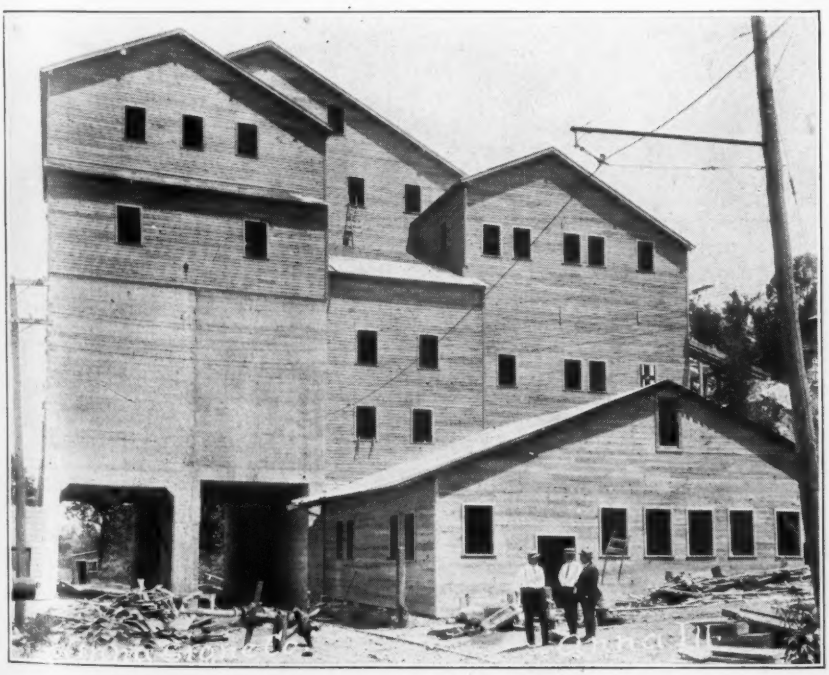
The quarry pit is located near the center of the property, having approximately thirty feet of limestone above the surface level and sixty feet below the surface level, which gives a ninety foot working face about twelve hundred feet long.

They have drilled to a depth of six hundred feet and are still in solid limestone, some seams being forty feet in thickness. There is an average of approximately eight to ten feet of clay overburden which will be removed with a steam shovel loading into side dump cars and hauled with gasoline locomotive and dumped into a ravine approximately sixteen hundred feet from quarry opening.

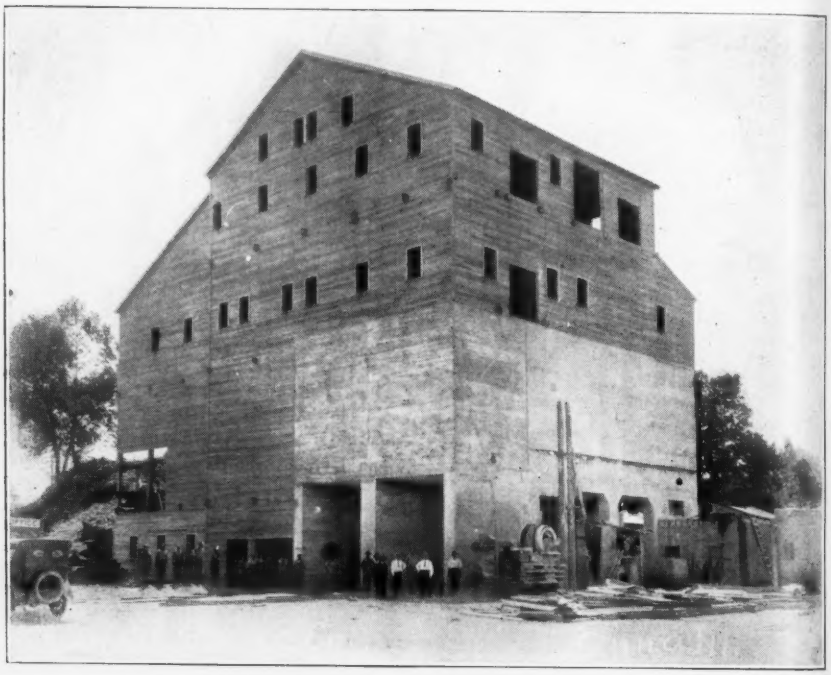
Steam shovels to load stone in the quarry will be installed. Gasoline locomotive will draw five ton quarry cars to the foot of the inclien to the crushing plant. The present crushing plant has a capacity of five hundred tons per day, but the new equipment being installed will give a capacity of two thousand tons per shift or thirty-five hundred tons per day with two shifts.

A Loomis Clipper Electric driven well drill outfit for drilling the total depth of the ninety foot face of stone is used. A six inch hole is drilled and five by eight inch dynamite used for blasting. Air drills are used in "dobie" and block hole work for reducing the larger stones to sizes suitable for the shovels.

The air compressors and drills are



View of Crushing Plant and Storage Bins.



Views of the Old Incline and the New Crushing House.

contracted for with the Sullivan Machinery Company. The plant building including concrete storage bins is seventy feet by one hundred feet and ninety feet high.

The concrete storage bins have a capacity of two thousand tons, with two railroad tracks runnning beneath which permits loading four cars at a time, two cars on each track.

The tracks are so constructed as to have sufficient grade to run the empty cars under the bins and loaded cars from beneath the bins across the automatic scales to the storage tracks without the use of a locomotive.

The following machinery has already been installed: One number 12, two number 7½ and one number 5 Gyratory Crushers and one set of Rolls fourteen by thirty inch, together with Elevators, Conveyors, Cylinder and Shaker screens, all of which were furnished by the Allis-Chalmers Mfg. Co.

The entire plant consisting of crushers, screens, conveyors, air compressors, well drills, pumps, hoist and machine shop will be electrically driven, having a total connected load of over 700 H.P. in motors. The power is purchased from the Central Illinois Public Service Company at twenty-three hundred volts which is used throughout the plant from 220 volts with the small motors to 2300 volts with the larger motors.

The Central Illinois Public Service Company have a large generating plant at Harrisburg, Illinois, which is approximately forty miles North and East of the plant, which connects by transmission line with their large plant at Grand Tower, Illinois, which is thirty miles North and West of the plant. This gives two sources of feed which assures excellent power service.

Before making any steps toward the expenditure of money, the Anna Stone Company thoroughly investigated the various limestone deposits within a radius of fifty miles, making numerous tests as to quality and quantity for agricultural and other purposes together with location for distribution facilities. Finding nothing to compare with this deposit, they proceeded to build a larger plant.

Mr. J. J. Marshall of Chicago, who has had a wide experience in the building of crushing plants has been in full charge of the entire construction of the new plant and installation

Showing the No. 12 Crusher Being Installed.

of all machinery.

The following are the names of the officers and directors of the company: G. H. Rippetoe, President and General Manager, Anna, Ill.; Wm. Ganschow, Vice-President, Chicago, Ill.; A. F. Hearl, Secretary, Chicago, Ill.; Chas. E. Browne, Treasurer, Chicago, Ill.; G. A. Dahlberg, Attorney, Chicago, Ill.; L. B. Tuthill, Anna, Ill.; W. M. Brinkman, Chicago, Ill.; Otto Cederwall, Chicago, Ill.

Anderson Company Reorganizes

Announcement has been made of a complete reorganization of the Anderson Foundry & Machine Co. of Anderson, Indiana. This company will begin operations at once under the new corporation name of "The Anderson Engine & Foundry Co."

Another item is the information that the type "K" Anderson engine is to be placed on the market, greatly improved, in the same sizes as previously marketed, namely, 30 to 325 H.P.

The new corporation is amply financed, and is headed by a directorate composed of manufacturers and business men of national reputation.

Link Belt School for Salesmen

The Link-Belt Company of Indianapolis has adopted a new plan of bringing their distributor's key men to their factory. Here these men may see the products in process of manufacture, listen to prearranged lectures, and become more fully acquainted with general manufacturing procedure, policy and personnel.

The Link-Belt Company allows each distributor to select the salesmen for attendance at this "School on Manufacture," paying all expenses incident to the three day visit, except the value of that salesman's time.

On August 25-6-7, the Link-Belt Company held such a school at their Ewart Works in Indianapolis, under the direct supervision of Mr. George Torrence, sales manager.

"We are very much encouraged over the results of this school," Mr. Torrence said. "It is our intention to make this distributor's school an annual affair."

Catalog M-24, containing description and illustration of Brownhoist Belt Conveyors, has been issued by the Brown Hoisting Machinery Co. of Cleveland, O.

View of the Old Quarry.

Is Your Blasting Effective?

Written Expressly for PIT AND QUARRY by DANIEL J. HAUER.

IN every quarry blasting must be done. In a crushed stone quarry it is a most important item, and stone cannot be produced cheaply if the blasting cost is high and this work is done in an inefficient manner.

It is necessary to know if blasting is done well. This is a comparatively easy matter. If the ledge is examined carefully and the stone can be picked up and loaded readily, the blasting is being done well. For instance, if there are no overhanging faces left to the ledge, if the toe of the ledge is shot up, and the marks of the drill holes are not left on the ledge, and if there is little if any secondary blasting to be done, then the blasting is being done well.

These things, however, do not tell the story of the effectiveness and low costs. In order to know these, careful records must be kept. The fact that the blasting is satisfactory to look at does not mean that effective blasting is being done. A steam shovel may be able to pick up the blasted rock without interruption, yet to allow this to be done, the drilled holes may be spaced entirely too close, and the charges in the holes may be larger than necessary, thus making the cost excessive. The blasting should be done so as to allow the rock to be picked up easily, and the stone should be broken to such sizes as will readily enter the crusher. At the same time the cost should be kept to the minimum.

This is a statement easily made, but it is quite difficult to say what the minimum cost should be, not only in any particular kind of rock but also in each quarry. The cost of blasting will vary in granite from limestone and sandstone and likewise in other kinds of rock. Even in two quarries of the same rock, say limestone, the blasting in one may be much more expensive than in the other. It is exceedingly difficult to set a standard for all quarries, yet it is possible for each quarry to set its own standard and to use it as a guide for effective blasting.

In spite of this there are some general rules that can be laid down and some facts given that are a decided help in setting such a standard for any quarry. The fact is that rules can be laid down for spacing and drilling holes and also for deciding upon the charges to use in the holes.

This is much better than leaving the matter to the judgment of a practical blaster. The basis of all blasting should be the number of cubic yards to be loosened and broken. It must be remembered that in blasting it is as necessary to break up the rock so that it can be handled as it is to loosen it from the ledge. Thus to obtain effective blasting the characteristics of the explosives must be known, as well as their relative strength and the yardage of tonnage of the rock to be moved. Then nothing is left to guesswork.

Guessing in many cases may give seemingly good results, but it may be quite expensive. When black powder was in common use for the open cut work, many practical blasters would guess at the number of kegs to be used in a hole. They had a saying, "Put in another keg for the contractors and one for myself." It is obvious that if he has guessed right at first, the two extra kegs are wasted; while if these two kegs are absolutely needed, then his guess was wrong. As practical blasters were wrong about this, so today they have many erroneous ideas and notions about explosives.

There are two prevailing beliefs that are wrong and cause the wasting of much money. One is that black powder shoots up and dynamite shoots down. Nothing could be farther from fact. Black powder is a low powder explosive. Dynamite is a high powder explosive. These are the two powders in most common use, although a third powder, called by different trade names is used. The best known of these is Judson powder.

The action of all powders in exploding is the same, except that they explode from a different cause. One will exert its power more quickly and has more power. This is due to the fact that one powder is converted into gases more rapidly and in larger quantities than another. Such powders are termed high explosives, yet they may not be as dangerous to handle as low explosives. If an accident does happen and there is a premature explosion, more damage

will be done than with a low explosive.

All blasting powder exerts the same pressure in all directions, but it does the most work in the path of least resistance. Therefore it throws out the rock in a blast that is in front of the drill holes and above the quarry floor. The higher power the explosive has, the more work it will do behind the drill holes and below the quarry floor. In other words the more rendering of the rock it will do pound for pound. This is the reason that black powder is less effective in breaking behind and below the charge than is dynamite. A pound of dynamite exploded under the same conditions as black powder will render more rock.

With these facts understood it can be seen that within certain limits the larger and more compact the chamber in which the explosives are to be exploded, the more effective will be the work. This shows the need of springing blast holes so that the charge is confined as much as possible to the bottom; for the greater the weight and resistance up to a certain limit, the larger the amount of work the explosive will do in throwing out and breaking up the rock.

It is for these same reasons that the drill hole should be closed with stemming or tamping before the charge of powder is exploded. The loss of powder through one hole is not large, but with a large number of big bore holes considerable powder can be lost in a blast. The cost of tamping the holes will generally be less than the loss sustained through not filling the holes with tamping.

There are three factors that must be considered in obtaining the most effective results from blasting: (1) the spacing and depth of the blast holes, taking into consideration the kind of rock and how the ledge runs; (2) the kind of explosives used in the holes (a high and low explosive should never be used in the same hole); (3) the size of the charges of explosives and how they are placed in the holes.

These three factors govern any kind of blasting in open cut or quarry work. The spacing of holes is the first consideration, and there is not an expert in the world who can do successful and economic blasting unless he spaces his holes properly. If holes are placed too far apart, the cost of the secondary blasting is likely to be high and the total cost excessive. If holes are spaced too close, the rock may be well broken and easily handled, but the cost may be excessive.

Many operators today err on the side of spacing holes too close together. In the past trouble was experienced in using steam shovels for loading rock due to poor blasting and there was much lost time. In order to prevent this the closer spacing of holes followed, so that today the opposite results are obtained; yet the cost is still high.

Many blasters seem to follow a single rule for all spacing of holes. The writer visited a large crushed stone quarry where they were making great preparation during the winter for a blast that would throw down enough stone in the spring for a season's work. Several well drills had been at work all winter. Three breasts were being worked in the quarry. One was forty feet high. One was eighty-five feet, while the third was one hundred and thirty-five feet. The big blast drill holes on all of these faces were drilled ten feet apart. It was stated that this was the rule in this quarry.

It is evident that money was being wasted here not only for drilling but also for explosives. If ten feet was the correct spacing for the forty foot ledge, (the writer believes this was wrong), then it is evident that the two higher ledges could have had a wider spacing, and the one hundred and thirty-five foot ledge could have used a wider spacing than the eighty-five foot one.

In another quarry with not nearly as high a breast, the rule was for a fifteen foot spacing of holes. Here there were three lines of holes put down parallel to the breast. It is obvious that if the first row was spaced fifteen feet behind the top of the breast, the other two rows were spaced too far apart as their load was more than that carried by the first row.

The two cases serve to illustrate how a rule that is not based upon knowledge of the use of explosives and of the particular rock quarried serves only to increase the cost, and to give less efficient results than can be obtained by the proper spacing of holes and use of explosives.

If blasters use some rules to decide upon the various features of blasting, based upon their own knowledge, it is possible to derive formulae

that can be used for the same purpose, and that result from the vast fund of information gathered from many blasters and experts. Such formulae should be used with discretion, as should all rules. This being the case it can be seen that it is possible to have certain standards to follow so that efficiency can be obtained and maintained.

Some years ago the basis of judging blasts in quarries was with black powder. Inasmuch as but little of this explosive is used at the present time for this class of work, it is no longer considered. Dynamite has become the explosive for general use, so that a dynamite of forty per cent grade or strength is now used as the basis of blasting.

Authorities differ widely as to the yardage that a pound of such explosive will loosen. Fortunately it is not a question of what they do loosen in ordinary blasting, but rather of what they should loosen, so that comparisons can be made with a standard to see what efficiency is obtained.

The writer has some published records before him of large blasts. One is a limestone quarry where it is stated that 22,000 pounds of dynamite broke down 83,671 tons of rock or almost four tons to the pound. Meagre information is given; nothing as to height of the ledge, the spacing of the holes, or the strength of the dynamite. It is just a statement of pounds used and tons thrown down. No doubt the explosives used for secondary blasting are not recorded, so that the tonnage to the pound was less than stated.

Another record is given of throwing down 250,000 tons in a quarry and breaking it up well with forty-eight thousand pounds of explosives. This meant a little more than five tons to the pound of explosives. The kind of stone is not mentioned, but from the location of the quarry we may conclude that it was probably sandstone. It is stated that 71 blast holes made with a well drill were used, the holes varying in depth from 30 feet to 157 feet.

In another quarry producing limestone it is stated that the rock is full of seams, cracks and crevices, precluding well drilling, so that black powder in coyote holes or tunnels is used to throw down the rock, and sixty per cent dynamite for breaking up the boulders. In a season this quarry produces 400,000 tons of rock using 87,500 lbs. of black blasting powder, while more than 190,000 lbs. of 60 per cent dynamite are used to break it up.

This shows a record of about 4.6 tons of rock being thrown down by a pound of powder, while it took one pound of the extra strength dynamite for each 2.1 tons of rock for breaking up the boulders.

In a granite quarry 215,000 tons of rock were produced with 151,000 pounds of dynamite. This meant 1.42 tons of rock per pound of explosives. In these last two cases the powder used includes that for both primary and secondary blasting.

Here are some actual records, no doubt selected for publication because they were thought to be especially good. They show the great range of work that explosives will do in different kinds of rock. The conditions under which the blasting was done are not known, so that few deductions can be made, yet even this information can be helpful. One thing of great interest is the use of black powder in one of the limestone quarries. There is little doubt that many quarry operators waste money by using dynamite exclusively. The writer does not urge that black powder entirely replace dynamite for deep hole blasting, but there is little doubt that much effective and economical blasting can be done in large shots in quarries with both black powder and Judson powder. To use these explosives in deep holes, springing must be done so as to place the charges in the proper kind of chambers. If deck shooting is done using dynamite for the top charges, the rock can be broken up well so as to do little secondary shooting, while large volumes of rock can be thrown down at less cost than with straight dynamite.

It will pay any operator who has never used black powder and Judson powder to experiment with them, remembering that they cannot be used exactly as dynamite is used. If intelligent handling is done, they will be surprised to find what economical results can be obtained.

Economical blasting in deep holes can never be done, even when the hole is of large diameter, unless holes are well sprung. Without springing the charge is mainly in the barrel of the hole, while with springing the charge is in a chamber at the bottom of the hole.

Naturally in springing holes the depth of the hole must be considered. Holes less than twenty feet deep cannot be considered deep ones. Such holes could only be sprung with a small amount of dynamite and shot with dynamite only. It is the much deeper holes that are being discussed.

It can be seen from the examples given that the tons of cubic yards of rock were much less than those to be given in the table below. It is not our idea to put the figures excessively high, but naturally they are higher than those cited, being figures that can be obtained under the best conditions and when explosives are handled in the most intelligent manner.

	Cubic Yards	Factor to convert yardage to tons (Solid Rock)
Triable sand stone	3 to 4	1.6
Hard and dense sand stone	2½ to 3½	1.75
Shales	3 to 4	2.
Slate and heavy shales	2½ to 3½	2.2
Limestone (soft)	3 to 4	2.1
Limestone (hard)	2½ to 3½	2.25
Dolomite	3 to 4	2.3
Serpentine rocks	2½ to 3½	2.2
Schists	2¾ to 3¾	2.3
Gneiss	2½ to 3½	2.35
Trap rock	2¼ to 3¼	2.4
Dense trap rock	1¾ to 2½	2.4
Granite	2 to 3	2.5

The first column gives figures that should be possible in most heavy blasts, where several thousands of cubic yards are blown down at one time. The second column shows figures that can be obtained under the most ideal conditions. The third column gives the factor for converting cubic yards, solid or place measure, to tons. These tons must not be confused with a ton of crushed rock. In converting cubic yards of crushed rock to tons a slightly different factor must be used.

This table will serve as a guide to any operator, superintendent or blaster. In some particular quarry these figures may not be obtained, in others they may be. Whether obtained or not, if they are used, it will be found that the blasting being done will be improved from month to month and from season to season, so that the cost of blasting will be considerably reduced.

Every operator should be open to conviction on such matters and should not be satisfied with what he may have done. With blasting as with all other lines of work he should strive to improve his present methods and thus reduce his costs.

New Incorporations

Pioneer Silica Products Co., St. Louis, Mo., to operate silica properties, commercial reduction plants, etc.; $25,000. Incorporators: T. R. Reyburn, J. B. Bergs, and A. H. Sullivan, Arcade Bldg, St. Louis.

Edgewood Concrete Products Co., Inc., Springfield, Mass.; concrete and cement blocks, bricks, etc.; 50 shares of stock, no par value. David A. Reed, president and treasurer; 131 Edgewood Gardens, Springfield.

Fasig Cement Co., Anna, Ill.; to operate a cement mill; $250,000. Incorporators: Daniel H. Oskin, John C. McGinnis and Fred Magaw, all of Anna.

Needham Sand & Gravel Co., Needham, Mass.; builders and contractors; $25,000. Incorporators: Massimiliano Ruggiero, Vincenzo Rossi, and Pasquale Di Filippo of Boston, and Benedetto Generazio of Newton.

Portland Sand & Gravel Co., Morristown, N. J.; mining and dealing in sand and gravel; $125,000, of which $100,000 is for common stock and $25,000 preferred.

Ohio River Sand Co., Pittsburgh, Pa.; $50,000; Joseph R. McGaw.

Barnhart Cement Products Corp.; to manufacture cement; $50,000; G. E. Barnhart, New Brighton, Pa.; O. C. Grossglass, S. R. Hamilton, Beaver Falls, Pa.; (Corp. Service Co.)

Chattanooga Brick & Tile Co., Chattanooga, Tenn.; $150,000; by F. A. Stephenson of Iowa, interested in the Signal Mountain Portland Cement Co.; his son, N. W. Stephenson of Mason City, Ia.; J. J. Coffey of Pennsylvania; J. C. Hollenback and W. B. Swaney.

Black Rock Asphalt Co., Inc., Wilmington, Del.; manufacture and sale of asphalt and cement; capital, $1,000,000.

Williams-Laflin Sand & Gravel Co., Texarkana, Texas; to mine rock, sand and gravel. Will build $40,000 plant, and a 4.000,000 gallon water reservoir. Officers: Chester S. Williams, president; A. D. Keeney, vice-president; Dan C. Laflin, secretary-treasurer; and William M. Shane, field superintendent.

Weston Sand & Gravel Co., Logtown, Mass.; capital $30,000; by Lamar Otis, S. W. Weston and C. L. Weston, incorporators.

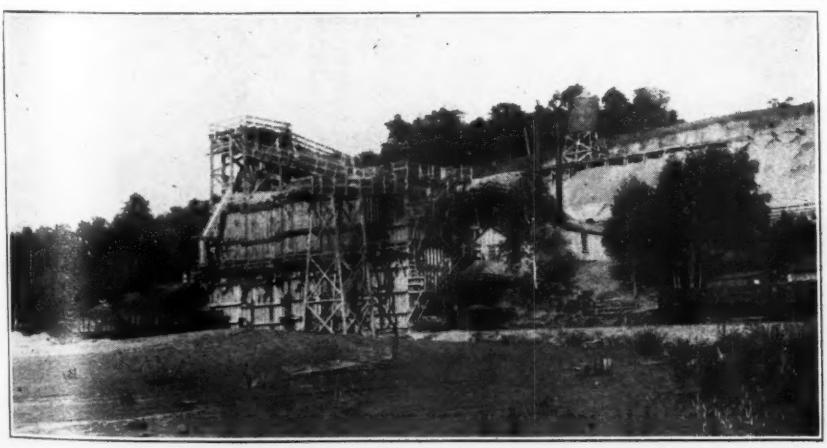
An Unusually Efficient Canadian Sand and Gravel Plant

Plant Efficient in Design and Substantial in Construction Belt Conveyors Nearly Horizontal-Half of Deposit in Hill

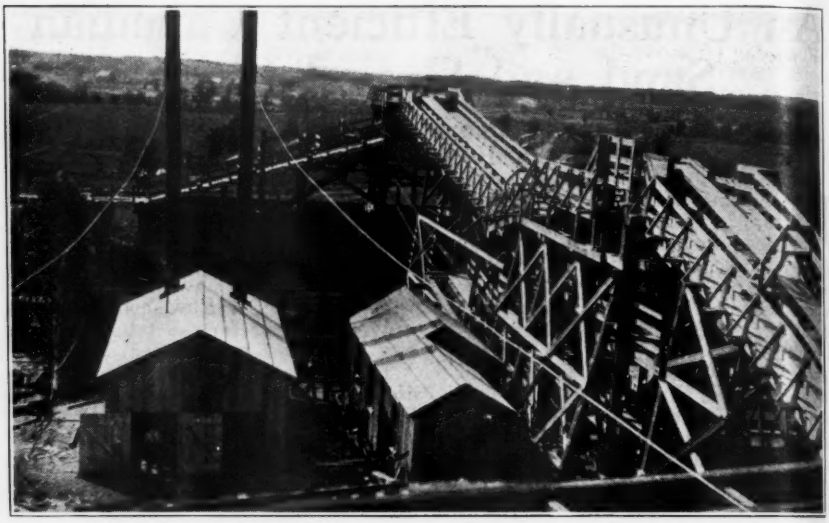
THE plant of A. W. Robertson, Ltd. in Hastings County 18 miles north of Belleville, Ontario, Canada is unusual in many respects. Of the 400 acres of gravel deposit owned by the company, at least half of it is in the form of a hill about 225 feet high. The site is close to the Canadian National Railways Railroad and spur lines have been run into the plant. The market this plant serves extends from the extreme east of Ontario west to the City of Toronto. The Rogers Supply Company, Ltd., are sole distributors in Toronto and they have a number of yards for storage with electric cranes for unloading cars and loading their 7-ton trucks for local delivery. The plant has a capacity of 2,000 tons of sand and gravel a day and ample facilities for handling this output have been provided.

The high grade of sand and gravel produced is due largely to the fine deposit. Tests made at various points in the deposit indicate that gravel runs for the entire depth. There is practically no overburden and only occasionally does it exceed 6 inches. The deposit is composed of hard dense stones well proportioned with sand and fines without any clay or stratified rock. There is an enormous quantity of sand and gravel available which can be produced without necessitating any changes in the method of operating or the location of the plant. All these features have been taken advantage of and the washed sand and gravel prepared for the market is usually clean and well graded.

The pit is a side-hill cut with the digging about 75 feet up the slope. By opening the cut at this level instead of at the bottom the material is made to flow from the dumping hopper to the belt by gravity. A number 70 Bucyrus shovel with a 2½ yard bucket loads the material into 6 yard standard gauge Western dump cars. This same shovel handles what overburden there is to remove. These cars are drawn ten at a time by a Plymouth 7-ton gasoline locomotive to a dumping trestle about 250 yards from the present working face, and dumped into a storage pile below the trestle. This storage pile is retained by timber cribbing. The material flows out by gravity to a plank hopper supported on heavy concrete foundations. The dump storage pile is large enough to provide material for night operation of the plant without operating the pit. From the hopper the gravel is carried by an apron feeder to a belt which



General View of Plant Showing Digging Level in Rear.



Looking at Plant from Dumping Trestle.

elevates it only slightly to the scalping screen. This scalping screen has 2½ inch holes and the oversize from this screen passes to a number 5 McCully gyrator crusher set with a 2-inch opening. The material passing the scalping screen passes to a belt conveyor and is delivered either to the screening and washing plant or is delivered directly from the end of the belt conveyors down a box chute into the cars if sold as pit run. The trestle work supporting the belts, scalping screen, etc., is made up of 8x8 inch and 10x10 inch posts on concrete footings. The posts are braced with 2x8 inch timber.

The material from the crusher is elevated by a conveyor belt to the feed belt leading from the hopper to the scalping screen. All material going to the washing and screening plant must pass the scalping screen.

The washing plant consists of three

A Train of Nine Cars On Trestle Ready to Unload.

From Top of Plant Looking Towards Dump Pit.

Dull conical screens and two 72 inch Dull cones, furnished by the Link Belt Company of Chicago. Each of the screens is 32x72x96 inches. These screens have 1¼, ⅝ and ¼-inch perforations respectively. An ample water supply is available ¼ mile away. This supply is in the form of a reservoir as a result of damming a creek and a storage of 12,000,000 gallons is provided. A 100 H.P. steam engine drives a Morris centrifugal pump which delivers the water to the plant through an 8 inch pump line under 60 pounds pressure. This water is delivered to the nozzles directly and any surplus is fed to an 18,000 gallon reserve tank. This tank feeds the washing plant when the pump is not operating and provides fire protection to the plant. This tank is connected by pipe lines to the steam shovel, the

View Showing How Side Hill Was Taken Advantage Of.

boilers and to the fire plugs. The sand passing the ¼ inch screen is cleaned in a sand washer and discharged into a sand bin or dumped directly into cars.

The storage bin is 83 feet long, 17 feet wide and 38 feet high and is divided into 5 compartments to handle two inch gravel, one inch gravel, pea gravel, sand and pit run gravel. There is a siding on each side of the bin and each compartment has four chutes, two on each side. This storage bin is substantially constructed of planking securely bound by heavy iron rods running longitudinally and transversely. The bin rests on 168 piles 18 to 20 feet in the ground. Over these piles is a 2 foot slab of concrete with concrete walls and partitions 5 feet high and 2 feet thick on which the superstructure is built. Drainage is handled by a trench around the bin. This trench is filled with stone.

The power for the plant is steam. Two 60 H.P. boilers supply steam to a 120 H.P. boiler. The crusher, belts and scalping screen are belt driven while the washing screens are rope driven.

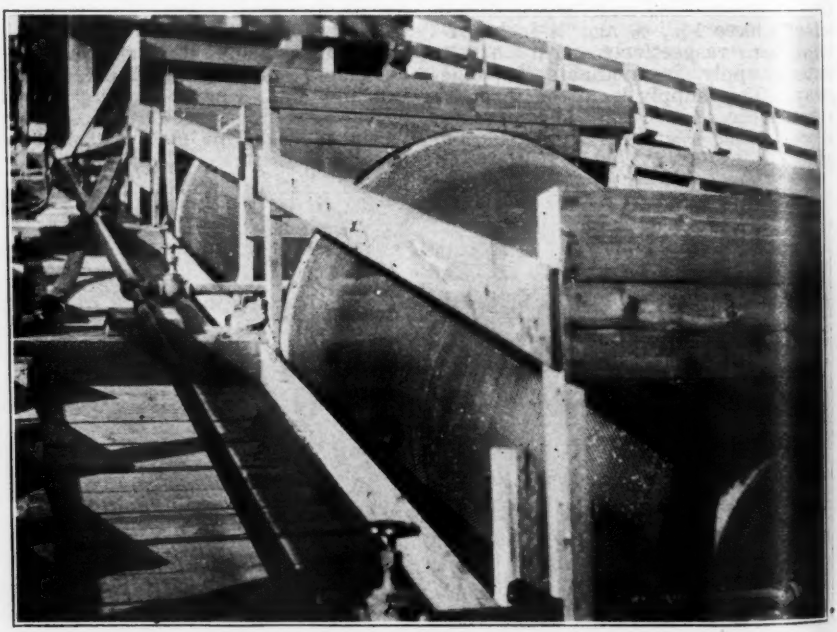
There is a portable roof available for the belts, screens, etc., which is put on in sections when the plant is closed in the winter months. Three men in a day can easily put this roof up.

Safety of the employees is one of the main thoughts of this company. They have not had a single accident to report to the Workmen's Compensation Board and every effort is being made to keep the slate clean.

The capacity of the plant at present is 2,000 tons of washed sand and gravel daily. There are track facilities for 50 cars and incoming and outgoing cars can be handled easily. The plant is managed by Mr. W. E. Tummon who has been with A. W. Robertson, Ltd., since 1911. The plant was designed by Mr. E. S. Miles who also supervised the construction. Mr. Fred Cotton is superintendent of the plant.

The Monolith Concrete Construction Co. of Corpus Christi, Texas, has been organized, with capital of $12,500, by W. W. Chapman, L. B. Griffith and Carelton Griffith.

The Dallas Sand and Gravel Co. of Dallas, Texas, has been organized with capital of $16,000 by Y. J. Hawkins, H. A. Turner, and A. Bevacgua.



The Washing Screens.

Liquid Oxygen Demonstrates Power New Explosive Lifts 4500 Tons

By F. W. O'NEIL*

NEARLY 98,000,000 tons of stone for crushing, for furnace flux, for rubble, for riprap, and for various other purposes were produced by our numerous quarries during the year gone. This output represented a substantial increase over that of 1922; and the upward trend continues in this field of industry, which contributes to many needs.

Plainly, the blasting of rock is a much bigger business in this country than most people realize. To shatter and to dislodge this rock from the ledge requires every twelvemonth the use of millions of pounds of powerful explosives. For this work dynamite is extensively employed.

It is self-evident that substantial economies would result if the quarryman had at his command a cheaper and an equally effective blasting agent —in short, one that would answer as well as dynamite and have, besides, some distinctive merits which would make its adoption especially desirable. Happily, such a medium is to be had in L.O.X.—the accepted abbreviation for liquid-oxygen explosives.

Off and on in this country, both the technical and the popular press have had something to say about this kind of explosives; and a fair percentage of the public is aware that liquid oxygen explosives were brought to a commercial stage of usefulness mainly through the exigencies of war and the enforced efforts of certain of the European belligerents to conserve their precious stocks of fixed nitrogen.

These informed people also know that L.O.X. has been retained since the cessation of strife as a substitute for dynamite in some important mines abroad, and they are familiar with the fact that the performances of

*Chief Engineer, Ingersoll-Rand Company.

4,500 Tons of Rock Lifted By This Shot.

View Before Blast Was Fired.

View After Blast Was Fired.

these explosives have been decidedly satisfactory and of much suggestive value. On the other hand, relatively few persons have yet learned that American experts, after much research, have brought the art of manufacturing liquid-oxygen explosives to a more advanced stage than that attained abroad, and are now in a position to give our quarrymen and our mine operators the benefit of these improvements. Probably, the measure of this progress can be better understood if we describe a demonstration made recently at a quarry in Pennsylvania. That blast has made it possible for us to draw a direct comparison between the performance of dynamite and L.O.X. when tested under similar service conditions.

On March 5 of the current year, some preliminary blasting was done with L.O.X. at Myerstown, Lebanon County, Pa., on the property of the Calcite Quarry Company, and as a consequence of the excellence of that showing the quarry company gladly assented to a second demonstration. The latter was carried out on April 11 by officials of the Air Reduction Company and the Ingersoll-Rand Company who had had to do not only with the designing and the construction of the plant which furnished the liquid oxygen but who also worked out the details for the application of L.O.X. to the blasting of churn-drill holes. It is hardly necessary for us to emphasize that success depends largely upon the get-up of the cartridge. Among the interested spectators were representatives of the mining and quarrying industries as well as others who have to do with the use of explosives.

The object of the second demonstration was to conduct a complete blast in accordance with the usual procedure followed by the Calcite Quarry Company in its routine operations. This took the form of a 12-hole blast on a 30-foot bench which was located at one end of the quarry. The drill holes were spaced about 12 feet apart, as indicated by one of the accompanying illustrations, and each of these holes was 28 feet deep and 5½ inches in diameter. The cartridges were 5 inches in diameter and 18 inches long, five of them being placed in each hole. For stemming, loose loam was poured into the holes, and none of this material was tamped.

The cartridge cases or bags were made of stout muslin and filled with finely divided carbonaceous material which was of a highly absorbent nature. Before soaking in the liquid oxygen, each dry cartridge, in its complete form, weighed 3.25 pounds—the entire lot of 60 cartridges used in the blast weighing in this state 195 pounds. As has been determined, each unit of carbon requires for its complete combustion to CO_2 a total of 2.66 units of oxygen. However, the ratio of absorption in the case of the cartridges employed at Myerstown was 3.5 units of oxygen—the excess oxygen allowing a correspondingly longer period in which to load the holes and make other preparations before evaporation brought the explosive to the CO_2 point. Indeed, the CO_2 point can be passed without materially diminishing the force of the explosion. As a matter of fact, explosive action with cartridges of the kind in question can be obtained any time within two hours after they have been saturated and placed in the drill holes ready for detonating.

The liquid oxygen required for the demonstrating blast was delivered at Myerstown in forty 15-liter transportation bottles—the outward character of which can be seen in one of our illustrations. These containers are so constructed that they minimize evaporation of their liquid-oxygen content while in storage or in transit. When filled and ready for shipment, early in the evening of April 7, the net weight of oxygen in the bottles amounted to 1,541 pounds. When the containers reached their destination in the forenoon of April 11, they held a total of 1,014 pounds of liquid oxygen—representing a loss of 527 pounds or 34 per cent. during a transportation period of 88 hours. In other words, there was sustained by evaporation a loss of 9.3 per cent for each 24 hours.

When the soaking of the cartridges was begun there was available, therefore, 1,014 pounds of liquid oxygen. Sixty-one cartridges were soaked although but 60 of them were actually utilized for the blast. When the soaking of the entire lot was completed there remained unused 93 pounds of liquid oxygen—that is to say, each cartridge absorbed substantially 15 pounds of the fluid, and the whole lot required 921 pounds for their saturation. The theoretical weight of oxygen needed for 61 cartridges, based upon the 2.66 ratio per unit of carbon, is 525 pounds; and, therefore, the oxygen factor in this demonstration was 1.75—this figure being obtained by dividing 921 by 525. As can be

seen, an excess of 75 per cent of liquid oxygen was used over that necessary to insure the cartridges being above or at the CO_2 point after the lapse of a considerable period following their withdrawal from the soaking vessel.

The soaking vessels used abroad are not large enough to accommodate at one time more than a single cartridge of the size fired at Myerstown—the European cartridges being much smaller. The restriction is objectionable, as any practical man can readily appreciate, because of the time that would be required to soak a large enough number of cartridges. To overcome this difficulty, and to make it feasible to soak simultaneously twenty or more cartridges, an insulated tank was built for the quarry demonstration. This was a double-walled, box-like affair having the interspace filled with felt and the soaking chamber lined with copper. One of our photographs plainly shows the somewhat simple character of this tank. The container proved entirely satisfactory, and the loss of liquid oxygen by evaporation was surprisingly low.

The cartridges were soaked in the liquid oxygen for about 30 minutes. In the first lot 35 of them were so dealt with—enough to load seven holes. Then a second batch consisting of 25 cartridges was soaked, and when ready these were used to load the five holes remaining. The time intervals were as follows: Started to withdraw the first batch of cartridges from the liquid at 2 P. M.; and the first set of seven holes was completely loaded by 2:30. Started to soak the second batch at 2:30; and the remaining five holes were loaded by 3:05 o'clock. All twelve holes were shot in unison at 3:35. There was intentionally a lapse of 30 minutes between the time the cartridges were in place in the twelve holes and the moment of firing. In fact, there was a total interval of 1 hour and 35 minutes from the moment the first of the cartridges were taken out of the liquid oxygen until the blast was set off. This point is an important one, for it emphasizes that large quantities of L.O.X. can be used for a single blast and ample time allowed for the deliberate placing of the cartridges, for doing the needful stemming, and for making what other arrangements

The Shattered Rock Shows the Effectiveness of Small Cartridge.

may be necessary to insure thoroughly effective results.

To fire the 60 cartridges there was hung in each hole from top to bottom a suitable length of TNT Cordeau, and the twelve lengths of Cordeau were connected above ground to a common trunk a single cap on the trunk fuse serving to set off all the charges at the same instant when detonated electrically. According to officials of the Calcite Quarry Company, for a similar blast under ordinary conditions they would use 85 pounds of 40 per cent dynamite in each hole, or a total of 1,020 pounds.

It was estimated that 4,500 tons of rock were broken by the blast or 6.2 tons per pound of L.O.X. employed. Had 1,020 pounds of dynamite been used instead and a like quantity of rock broken, this would have meant 4.4 tons of rock for each pound of explosive. It was the judgment of those in charge of the demonstration that the blast was overshot and that the same result could have been obtained with 20 per cent less L.O.X.

After the blast, about fifteen sizable boulders were block-holed—using in each boulder a cartridge 1¼ inches in diameter and 5 inches long. The explosive broke up the boulders into small fragments. It was conclusively determined that L.O.X. cartridges cannot be detonated in the open air by a fuse but that they will, instead, burn rapidly with a bright flame. This was proved by placing a few cartridges in the open and setting them off with fuses.

Now let us consider the monetary significance of the main performance. Assuming the total weight of the 60 cartridges to be 721 pounds at the CO_2 point, and putting the cost of the L.O.X. at 8 cents a pound—which is ample to cover fixed charges and loss by evaporation—then the total outlay for the liquid-oygen explosive amounts to $57.68. On the other hand, with dynamite at 13.25 cents a pound and 1,020 pounds of it needed, the bill for this explosive would be $135.15. At these rates, the expenditure for L.O.X. for each ton of rock was 1.28 cents, while the use of dynamite for the same service would have cost 3 cents. In short, the cost of L.O.X. amounts to but 42⅝ per cent of that of dynamite. If the assumption be correct that the blast was overshot to the extent

The Large Rocks Were Blockholed and Blasted with Small Cartridge.

mentioned, then the outlay for L.O.X. for a specific performance can be put at 34 per cent of that of dynamite.

A marked feature of the effect of the blast was a somewhat pronounced crater formed at the foot of the quarry face when the bench was lifted. This cavity served admirably to indicate the downward force exerted by the L.O.X., and the measure of this reaction is especially noteworthy when it is recalled that the loam used for stemming was not tamped at all but merely poured into the holes. This stemming was a red clayey earth which photographed black in some of the pictures, and the dust from this stemming was responsible for the density of the cloud blown skyward at the time of the blast.

The liquid oxygen used in this significant demonstration was produced by a plant operating under the Claude system — the system adopted by the Ingersoll-Rand Company for the manufacture of liquid oxygen in large quantities. This system has been developed by the renowned French physicist, Dr. Georges Claude; and one of the distinctive characteristics of it is that it is necessary to compress atmospheric air to only 1,000 pounds or possibly less to produce liquid oxygen. By other systems in use, the air must be subjected to an initial pressure of 3,500 pounds before liquefaction is accomplished. The greater efficiency and economy of the Claude process should, therefore, be self-evident.

The L.O.X. blast at Myerstown was the first of its kind on a commercial scale ever made in a quarry in the United States, and there are the best of reasons for believing that it was the largest blast of liquid-oxygen explosives so far set off anywhere. It was the climax of much work, and marked the overcoming of many obstacles.

Kelly Handles Anchor Products

An office has been opened by the E. B. Kelley Co. of New York at 520 Arch street, Philadelphia. This Company has taken on the Anchor line of products, made by the Anchor Concrete Machinery Co. of Adrian, Mich., in the Philadelphia territory. L. W. Cline, formerly with Staley & Morris Co., will have charge, with a full line of equipment and repair parts.

Du Pont Explosive Bulletins

A series of bulletins giving the safest and most efficient methods of using explosives, known as Explosives Service Bulletins, has been issued by E. I. DuPont De Nemours & Co., Inc., Wilmington, Del. The series includes the following, among many others:

Firing Quarry Shots—How to increase breakage and prevent misfires.

Springing Bore Holes—How to increase the safety and efficiency of the operation.

Care of Explosives from Storage Magazine to Bore Hole.

Safety Fuse—How to handle and use to secure best results in blasting.

Getting the Best Results with Permissible Explosives.

Velocity of Detonation of Various Types of Explosives.

Brands of Du Pont Explosives and Use to Which They Are Adapted.

Heil Mounted Hoist and Body

The Heil Co. of Milwaukee, Wisc., has installed a number of its Dump Bodies and Hydro Hoists on Warner Semi-Trailers for use with different truck tractors. This is in line with the necessity confronting many large hauling companies in the hauling of capacity loads to comply with the state laws now being enacted, which govern the size of loads hauled on highways and streets.

With the Heil adaptation of Dump Bodies and Hoists to Semi-Trailers, the weight of the load is distributed over six wheels, thus conforming with the laws which prescribe the amount of weight per square inch of tire surface. A dumping angle of approximately 45 degrees is secured with a tail-gate ground clearance of about 4 feet, and is said to make a fine unit for handling building supplies, sand, gravel, brick and other bulk materials in towns and cities where the hauling of a pay load is a serious problem.

The Trailer has a fifth wheel attachment through which power is transmitted from the motor to the hoist for dumping the load, and the drive is mechanical throughout. No piping is required as the pump is an integral part of the hoist.

The body has removable sides, a substantial steel subframe and all-steel tail gate, and front end. Bodies can be furnished to suit material hauled. Full information will be mailed on request.

Comparative Tests of Slag With Pittsburgh Sand and Gravel

By CORTLAND K. WHITEHEAD*

AT the present time there is an ever-increasing tendency towards economy in the industrial world which shows itself in the commercial use of by-product materials which were formerly wasted. One of the most important materials of this class is the slag from blast and open-hearth furnaces. Some mention has been made in the Engineering press of tests recently begun with this material in Germany to extend over a period of years.

Because of the trend of the times the writer decided to undertake a series of tests of fine and coarse aggregate for cement mortars and concretes. Similar tests were also made simultaneously with local sands and gravels, which underwent the same mixing and curing conditions so that fair comparisons might be obtained.

The local materials received for the work were fair samples of the sands and gravels obtained from local rivers. Sufficient precautions were taken to keep the sand and gravel from the possible addition of foreign material. This was accomplished by storing the material in large separate bins where it remained until needed.

In the case of slag received the practice was different. This material, including both fine and coarse aggregate, was shipped in cloth sacks which made a very convenient form in which to handle it. Thus no further precautions were taken to keep it in its original condition than piling the sacks in a dry place.

Universal Portland Cement was used throughout the work and care was taken to see that this cement was in the best possible condition. To insure a uniform condition of all cement used, it was passed through a sieve having a diameter of .155 inches. The cement was then stored in a large air-tight can.

The local sands and gravels, namely, the Ohio and Allegheny, were in a more or less moist condition, so in order to secure absolute dryness and at the same time to insure a uniform sample of these materials, the total amount of each material that was required for all testing was determined in advance and this amount was collected and placed separately on drying surfaces over radiators where it remained two weeks before using. Small portions that were needed for immediate use were dried in small pans over gas burners. The same procedure was used in the preparation of the slag.

In order to secure a representative sample of any material for a test, a larger amount than was required was taken in each case. In taking this sample care was employed to get all portions of said material, including the fine dust-like particles as well as the coarser material, by first scraping all material needed from the drying surface into a receptacle and following this up with a careful brushing. This material was then piled on a clean surface where it was gradually worked down to a flat disc about 2 inches thick in the case of the fine aggregate, while in the case of the coarse aggregate the thickness of the disc was proportionately larger. Then, estimating approximately the amount required for any one batch of a mix, a sector of the disc was cut off and every particle of that sector taken by careful scraping and brushing.

Sufficient amounts of each of the fine and coarse aggregates were placed successively in the standard hopper, the opening of which was 12 inches from the top of the receiving 12-inch pipe whose capacity was 1.65 cubic feet. The opening in the hopper was regulated to allow the same to flow at the rate of one cubic foot per minute. The material in each case was allowed to overflow the receiving cylinder and then the material was made level with the rim of the cylinder. The weight of the cylinder and its contents was then taken.

A sample computation of the weight per cubic foot follows:

Weight of pipe empty = 164 pounds.

Weight of pipe filled with water = 267 pounds.

Weight of water = 103 pounds.

*From a thesis presented by Mr. Whitehead at Carnegie Institute of Technology.

The weight of cubic foot of water = 62.5 pounds.

$$\text{Volume of pipe} = \frac{103 \text{ pounds}}{62.5} =$$

1.65 cubic feet.

Weight of pipe filled with Ohio sand = 315 pounds.

Weight of pipe = 164 pounds.

Weight of sand = 151 pounds.

One hundred fifty-one pounds = the weight of 1.65 cubic feet.

$$\text{Weight of a cubic foot of Ohio sand} = \frac{151}{1.65} = 91.7 \text{ pounds.}$$

An 8-inch pipe, 4 feet long, capped at one end and having a glass tube connected to it at the lower end and extending its entire length, was employed for determining the percentage of voids. The tube had fastened to it a scale which indicated the change of water level in the pipe. After about 12 inches of water had been poured in the cylinder a known amount of the material to be tested was slowly added. A light tapping of the cylinder, while the material was being added, was done to release the entrapped air. The initial and final heights of the water were recorded. The difference of these heights gave the height of water displaced by the material added.

A sample calculation is as follows:

One inch height of cylinder is equivalent to .03025 cubic feet.

In the case of Ohio sand 74 pounds were added.

Final water level = 20⅞ inches.

Initial water level = 5⅞ inches.

Change of water level = 15⅛ inches.

Nominal volume of sand added = $\frac{74}{91.7}$ = .808 cubic feet.

Absolute volume of sand = 15⅛ × .03025 = .475 cubic feet.

Volume of voids = .808 — .475 = .333 cubic feet.

$$\text{Per cent of voids} = \frac{.333 \times 100}{.808} = 41.25$$

per cent.

The specific gravity of the materials was calculated directly from the data of the foregoing test, and obtained as follows:

The percentage of solid materials = (100% - 41.25%) = 58.75%.

A cubic foot of Ohio sand weighs 91.7 pounds.

$$\text{Specific gravity} = \frac{91.7}{.5875} \times \frac{1}{62.5} = 2.50$$

In the case of sand tests the following sieves were used: No. 4, No. 6, No. 10, No. 16, No. 20, No. 30, No. 40, No. 50, No. 74, No. 100. The diameter of these sieves is 0.200; 0.122; 0.073; 0.042; 0.034; 0.022; 0.015; 0.011; 0.0078; 0.0045 inches, respectively.

A sample weighing 5 kilograms was placed on No. 4 sieve and sifted by hand. After the residue was weighed the amount passing was placed on No. 6 sieve and the process repeated. When No. 30 sieve was reached only 1 kilogram of the amount passing No. 20 sieve was placed upon it. This was done to facilitate the sieving. The sieving was continued throughout the remaining sieves in the same manner as above stated. It was directed that the loss of any one test should not exceed one-tenth of one per cent. This condition was met throughout this test. There was no further need of sub-division of the amount passing the remaining sieves. The sieving, therefore, was accomplished without any further interruption.

Screens having openings of the following diameters were used in the gravel and coarse slag tests: 2.25; 1.75; 1.50; 1.00; 0.69; 0.43; 0.31; 0.25; 0.18; 0.15; 0.10 inches. All screening was done by hand, the following samples being used:

115 lbs. of Ohio gravel
123 lbs. of Allegheny gravel
118 lbs. of coarse slag

All tests on the cement were made as prescribed by the American Society for Testing Materials. For normal consistency 24 per cent of water was required; the time of initial set using the Vicat Apparatus was 55 minutes. The soundness test conformed to the specifications.

An interpolation made from the table of standard mortars gave 10.5 per cent of water for a 1:3 Ottawa mortar corresponding to the 24 per cent water value for the neat cement.

To obtain the percentage of water for the standard Ottawa 1:2 mix, the formula, $Y = \frac{\frac{2}{3} P}{N+1} + K$, was employed where $K = 6.5$, $P =$ percentage of water for normal consistency, and $n =$ Number of parts of sand to cement by weight.

The value of the water content in the standard Ottawa 1:2 mix is 11.83 per cent through proper substitution in the above formula.

To determine the proper percentage of water for the 1:2 and 1:3 mortars of the other fine aggregates used, several trial per cents of water were used and the resulting mortars compared to the 1:2 and 1:3 standard Ottawa mortars and their consistency made the same. The values of the various percentages of water, giving the same consistency, are as follows:

	Mortars	Per Cent of Water
Allegheny sand	1:2	15
Ohio sand	1:2	13.5
Slag sand	1:2	13.5
Allegheny sand	1:3	15
Ohio sand	1:3	12.0
Slag sand	1:3	12.0

Sufficient mortar for 2 cylinders or 4 briquettes was mixed in one batch. In ramming the mortar in the cylinder a cylindrical stick about 1 inch in diameter was used, the mortar being added in about 1 inch layers.

The top surface of the mortar was left rough and slightly below the rim of cylinder mold. Afterwards the cylinders were capped flush with the mold rim with neat cement.

In filling the briquette mold the mortar was added about a third at a time. After all the mortar was placed in the molds it was troweled down to a smooth surface flush with the mold under moderate pressure. The mold was then inverted on a glass plate and the opposite side was troweled in a similar manner.

In all there were 48-1:3 cylinders; 40-1:2 cylinders; 48-1:3 briquettes and 48-1:2 briquettes made for testing at various ages.

All cylinders and briquettes were cured under water until due for testing.

The cylinders and briquettes were made in lots of 24 at one time. This constituted a set, the marking being as follows:

Mark	Lot	Sand	Mix
O_1	1	Ottawa	1:3
A_1	1	Allegheny	1:3
H_1	1	Ohio	1:3
S_1	1	Slag	1:3
O_2	2	Ottawa	1:2
		etc.	

The mixing of all concretes was done by means of shovels. To insure uniform mixing of all concrete, the same men handled all concrete mixes. Sufficient material for six cylinders was mixed in each batch. The proper amount of sand was first spread out on a mixing pan; the cement was then placed on the same. These two materials were turned eight times. Then the coarse material was added. The mix was then turned 4 times in a dry state, after which it was turned ten times while the water was being added. Water was added until it began to run from the bottom of the batch. Upon piling the concrete it retained a good slope, while under considerable jarring of the mixing pan the concrete slowly sank to a nearly level mass. To obtain the amount of water used, the weight of an amount of water and container was taken before and after the proper amount of water had been added.

In filling the cylinder molds the concrete was added in about 3-inch layers and thoroughly puddled with a 1-inch round bar. The top surface of the concrete was left slightly below the rim of the mold which was made flush later, by a cap of neat cement. Difficulty in keeping the concrete uniform was encountered in the molding of the slag concrete. To minimize this fault the concrete was turned continually while being molded. All gravel was sprinkled before using, and all coarse slag was soaked for 24 hours before using.

All concrete cylinders were marked in the same manner as were the mortar specimens. The cylinders were then placed in moist sand beds, where they remained until needed for testing.

The mortars for the density test were made according to the methods previously stated, the same percentages of water being used.

The mortar was placed in the density cylinder in 1-inch layers and tamped with a metal tamper under moderate pressure. Three batches were required to fill the cylinder sufficiently. A metal plunger was placed on the mortar and turned several times to give an even bearing surface to the mortar. The distance of the top surface of the mortar below the rim of the cylinder was obtained.

The following example outlines the calculation of a mortar density:

Density of 1:3 Ohio mortar

2.700 grams of Ohio sand, 900 grams of cement used

Volume of cylinder = 129.25 cu. in. Volume of cylinder per inch of height = 9.96 cubic inches

Surface of mortar was 1.28 inches below top of cylinder

$$\text{Absolute volume of sand} = \frac{2.700}{2.50} \times \frac{1}{16.4} = 65.8 \text{ cubic inches}$$

$$\text{Absolute volume of cement} = \frac{900}{3.10} \times \frac{1}{16.4} = 17.7 \text{ cubic inches}$$

Total = 83.5 cubic inches

Volume as obtained from cylinder = 129.25 — (9.96×1.28) = 116.5 cubic inches

$$\text{Density of Ohio mortar} = \frac{83.5}{116.5} = 0.716.$$

The concrete for the density test was made according to methods formerly outlined. The concrete was placed in a large density cylinder in about 3-inch layers and thoroughly puddled. When the entire batch was placed in the cylinder a disc was placed on the surface of the concrete. The disc was turned several times to give an even bearing surface to the concrete; then the distance of the concrete surface below top of cylinder was obtained.

The following example outlines the calculation of the density of concrete:

Density of Allegheny Concrete, 1:2:4: mix.

For the calculation of the volume per inch height of density cylinder the following data was obtained:

Weight of cylinder filled with water = 128 lbs. 6 oz.

Weight of cylinder = 79 lbs. 6 oz.

Weight of water = 49 lbs.

$$\text{Volume of cylinder} = \frac{49.0}{62.5} = .785$$

cubic feet = 1,356 cubic inches.

For a difference in water level of $2\frac{1}{8}$ inches, difference in weight = 5 lbs., or a difference of 1.88 lbs. per inch; for a difference in water level of 2 inches, difference in weight = 3.69 lbs., or a difference of 1.84 lbs. per inch, giving an average of 1.86 lbs. per inch in height.

$$\text{Equivalent volume} = \frac{1.86}{62.5} \times 1728 =$$

51.4 cubic inches per inch

Weight of concrete and cylinder = 189 lbs.

Weight of cylinder = 79 lbs. 8 oz.

Weight of concrete = 109 lbs. 8 oz.

Surface of concrete $\frac{1}{16}$ inch below top of cylinder; equivalent volume = $\frac{1}{16} \times 51.4 = 3.21$ cubic inches

Total volume of cylinder = 1,356 cubic inches

Net volume = 1,356 — 3.21 = 1,352.79 cubic inches

Concrete left after filling cylinder = 6 lbs. 14 oz. = 6.88 lbs.

Volume of 6.88 lbs. by proportion

$$= \frac{6.88 \times 1352.79}{109.5} = 85.2 \text{ cubic inches}$$

Total volume of concrete = 1352.79 + 85.2 = 1438.00 cubic inches

$$\text{Absolute volume of Allegheny gravel} = \frac{66.06 \times 27.65}{2.57} = 712.3 \text{ cubic inches}$$

$$\text{Absolute volume of Allegheny sand} = \frac{27.78 \times 27.65}{2.62} = 293.0 \text{ cubic inches}$$

$$\text{Absolute volume of cement} = \frac{14.1 \times 27.65}{3.10} = 125.7 \text{ cubic inches}$$

where $\frac{1728}{62.5} = 27.65$

Total volume = 1,131.0 cubic inches.

$$\text{Density} = \frac{1131.0}{1438.0} = 0.788$$

The weight of a cubic foot of green concrete is obtained directly from the preceding data.

Weight of a cubic foot of Allegheny green concrete:

$$\frac{116.38 \text{ (total weight)}}{1438 \text{ (total volume)}} \times 1728 = 140 \text{ lbs. per cubic foot.}$$

Since we have the volume in cubic inches per 0.6 of a cubic foot of gravel, we may readily obtain the yield of green concrete per cubic foot of gravel, or $\frac{1438 \text{ (cubic inches)}}{1728 \times 0.6 \text{ cubic foot}} =$ 1.39 cubic feet per cubic foot of gravel.

All tension specimens were tested upon a standard Fairbanks testing machine, briquettes remaining under water until immediately before breaking. Standard practice specified by American Society for Testing Materials was followed in every particular.

In handling the compression specimens both mortar and concrete, care was taken to insure good plane bearing surfaces, and it was necessary to cap some of the specimens with Plaster of Paris which was allowed to harden for an hour and a half before placing in testing machine.

To break the specimen it was placed upon the spherical bearing which rested on the machine table and two thicknesses of blotting paper were placed on top and bottom of the specimen as an additional safeguard against uneven bearing surface. The load being applied continuously at the lowest machine speed the spherical bearing was slowly rotated from side to side until perfect bearing had been secured and the load prevented further turning. The machine was then thrown into second speed to an initial load of about one-third the ultimate load when low speed was again used until specimen failed.

The mechanical analysis of the three aggregates showed little difference in the coarse sizes, the slag having the largest per cent passing the sieves with the mesh from 0.2 to 1 inch square when it drops slightly below the Ohio and Allegheny gravels. However, the difference is so small that it need not be taken into account.

In the case of the fine aggregate the slag showed a much more uniform grading of material than either of the sands. The mechanical analysis curve showed 97 per cent of Allegheny sand passing the sieve of 0.8 inch mesh, and the Ohio sand had 81 per cent pass the same mesh.

The difference in grade between the two sands was apparent to the eye, the Ohio sand being much the coarser of the two.

There is practically no difference in the weight per cubic foot between the Ohio and Allegheny aggregates, the fine slag falling somewhat below the other two. Due to the porous nature of the coarse slag there is a large portion of its volume consisting of water while, also, there would be some of the pores of the slag containing entrapped air. This is not only a much lighter substance than the slag, but has a buoying effect as well. So it is readily seen why the unit weight of the slag is so low.

The Allegheny aggregate showed the highest specific gravity in both fine and coarse material with Ohio slightly lower in both cases and with fine and coarse slag the lowest, as was to be expected. For as we know, specific gravity is the relation of weights, and therefore what was characteristic in the foregoing paragraph would necessarily have a direct bearing upon the specific gravity. Therefore, the preceding explanation would be satisfactory here.

In the coarse aggregates the slag showed an abnormal percentage of voids due in part to its porous nature, and in part to its ragged, rough surfaces which in many cases would cause large openings that the finer material could not fill.

There is practically no difference in percentage of voids between the Allegheny and Ohio gravels, Allegheny being slightly higher.

In the fine aggregates the same thing holds true between the sands, the two kinds being practically identical. The fine slag, however, had a smaller percentage of voids than either of the sands.

The only explanation to be made in support of this result is that the mechanical analysis curve showed a much greater amount, proportionately, of the finer material, for the slag, than that of the local sands, and it is therefore natural to expect less empty space or voids.

Both the 1:2 and 1:3 mixes of the slag mortars were the best in tension of the four mortars tested, viz., the slag mortar, the Ottawa mortar, the Allegheny mortar, and the Ohio mortar, which is the order of their strength.

The hardest fact of this work to explain is the result obtained in the tests of the 1:3 slag mortar in tension. The results obtained for the slag were not only much superior to those of the other mortars, but the slope of the 1:3 slag mortar was very much steeper than those of the other mortars.

We shall not attempt to explain this result other than to say that the structure of the 1:3 slag mortar may have resembled, somewhat, the construction of a chain which stands high tension and relatively low compression.

The results of the 1:2 mortars give the slag mortar a far superior value in compression than any of the competitive sand mortars. We cannot state absolutely why such is the case, but we can, however, say that it is reasonable to believe that a mortar of the most compact ad homogeneous construction would give the most sat-

isfactory results. Therefore, we believe that such was the case with the 1:2 slag mortar in compression.

The order of the 1:2 sand mortars in compressive strength is as follows: 1, the slag mortar; 2, the Ottawa mortar; 3, the Ohio mortar; 4, the Allegheny mortar.

The compression tests of the 1:3 mortars showed a decided reversal of comparative values for the slag mortar. The other mortars had higher values than the slag mortar, and continued the same relative position of values. It is hard to explain this result in view of the comparatively high values otherwise obtained by the slag mortars, especially those of the 1:3 mortars in tension. The only explanation that is possible for us to offer in view of the fact that the mixes, both for tension and compression tests, were made at the same time and practically under the same conditions, is that either the two kinds of specimens did not set under the same immediate conditions or else the structure of the specimens was such as to offer a change of resistance under the different stresses.

While the compressive strength of slag concretes was very low the reason can be easily explained.

A 1:2:4 or a 1:2½:5 mix is not rich enough (in cement as well as fine aggregate) for a slag concrete due to a large per cent of voids, and the belief is expressed that raising the quantities of cement and fine slag 10 or 15 per cent would make a remarkable difference in strength. The fracture of the slag concrete cylinders seems to show that the voids were not completely filled as one would expect to find in a good concrete fracture. The physical structure of the fine and coarse slag grains was not such as would retain the cement grout to advantage, and a uniform concrete that would stand in a heap upon the mixing board such as one looks for with a good sand and gravel batch could not be obtained with these mixes of fine and coarse slag, the cement grout draining out of the batch and spreading out over the mixing board. This took place in spite of previous soaking of the coarse slag aggregate. Hence we believe that larger proportions of cement and fine slag are necessary to prevent the segregation of cement grout which appeared in these two mixes.

The good showing made by the mix of coarse slag and Ohio sand showed what can be expected of a slag which is so graded that it will hold the cement in place after thorough mixing. In this mix there was no tendency for the cement grout to separate and run out, but the whole mixture seemed to be uniform and went into the molds even better than the regular sand and gravel mix.

The 1:3 mortar densities are in the following order (from the highest to the lowest); the slag sand mortar, the Ottawa sand mortar, the Ohio sand mortar, and the Allegheny sand mortar. And with the exception of an interchange of the Ottawa and Ohio mortars the densities of the 1:2 mortars are in the same order, but the variation of this interchange is not large.

The 1:3 mortars are denser than the 1:2 mortars notwithstanding the fact that the 1:3 mortar is a leaner mix. This then would lead one to believe that the finer portion of the slag sand was the determining factor. This must be true, for the slag sand possessed the greatest proportion of the finer material in comparison with the other sands. And as the density of the slag mortar in both mixes is the highest, we feel that our assumption has been confirmed.

The slag concrete has the highest density value in both the 1:2:4 mix and the 1:3:5 mix. The same facts are true of the coarse slag as were presented in the preceding paragraph for the fine slag. Therefore, it is reasonable to believe that the cause for the slag concretes possessing the greatest densities is identical with that of the slag mortars.

We wish also to bring notice to the low void-percentage value of the fine slag, which property would undoubtedly be a confirmation of the density values obtained.

The strength of a material should vary directly with its density. The 1:2 slag mortars in tension and in compression made a very favorable showing in comparison to that of the sand mortars, and were in the proper strength relation with the other mortars as regards the law of density and strength.

The same can be said of the 1:3 mortars in tension, but the 1:3 slag mortar in compression failed to give results that would put it in the proper relation with the other mortars in regard to the density results.

In view of the fact that the 1:3

slag mixes both for tension and compression specimens were made at the same time and under the same conditions, and that the results of each differed so greatly, we are not able to give a satisfactory explanation, other than what has heretofore been given, for the failure in compression of the 1:3 slag mortar in this regard.

The strength results of the sand concretes were in the proper relation one with the other to conform with the density-strength law. However, the slag concretes gave strength values that were much lower than the sand concretes in spite of the fact that they possessed the greatest density. The density obtained, however, was not that of the cylinders tested, which were porous as has been elsewhere stated. Thus the results obtained are not at all surprising.

The strength of the 1:2 slag mortar far exceeded that of the other mortars and it maintained a very creditable increasing rate of strength in both compression and tension. The tensile strength of the 1:3 slag mortar held practically the same initial relation toward the other mortars as was attained by the 1:2 mortars, and furthermore the strength of the 1:3 slag mortar increased more rapidly than did the 1:2 slag mortar.

All the mortars attained their greatest increase strength rate in the period of from 7 to 28 days. From the 28th to the 91st day the mortars increased in strength at a fairly good rate.

The rates of increase of strength of the concretes are, on an average, very good. The rate of the slag-Ohio sand concrete was the feature of the tests. The increase of strength of the 1:2:4 Ohio sand-slag concrete was exceptionally good, and approaches the values claimed for a slag concrete.

In making a comparison of the yield values of the various concretes, we noted an appreciable difference in these values. In a case where the strength of the concrete is of minor importance a concrete of the greatest yield should be used. However, in the case where strength is the principal requirement the yield may be disregarded. In the case of the Ohio sand-slag concrete we have the greatest strength but the smallest yield of the set. One other economic feature is that of two concretes of equal reliability, the one having the greatest yield would be less expensive.

In building construction it is desirable to obtain a maximum strength value for a minimum weight of material used. Therefore, where we have two concretes of practically equal strength but of different weight, it would be desirable to use the lighter concrete. Then again where the requirement is for maximum weight for a given volume, as in the construction of a dam or a gravity wall, the heaviest concrete should be used.

Slag concrete of both mixes is the lightest in weight, but we must bear in mind that it is also the weakest concrete. The Ohio sand-coarse slag concrete is next to the lightest, but this concrete with one exception was the strongest concrete tested, and the difference in weight as compared with the other concretes of adequate strength is so significant that this is a decided advantage for the slag-sand concrete.

Although the work outlined was only partially completed owing to unavoidable delays in securing proper materials, the writer believes that the results set forth prove that fine and coarse slag have a place in the commercial production of concrete. We believe that with a little more experimental work in varying the proportions of cement, fine and coarse slag, several standard mixes can be worked out which will give more satisfactory results than an equivalent mix of sand and gravel.

We would also emphasize the fact that it is our belief that the tests made with the Ohio sand-coarse slag concrete warrant further investigation. The satisfactory results obtained show that slag can make a stronger concrete than regular aggregates.

Dings Magnetic Separator

Dings High Intensity Magnetic Separator, manufactured by the Dings Mfg. Co. of Milwaukee, after 25 years of development and manufacture, is said to have incorporated in its structure strength and endurance and power—just the right power for certain protection with the lowest possible current consumption.

The Dings Separator reaches out through the material, stops and throws aside the damaging iron before it gets to the crushers, to create a repair bill and cause a shutdown. Every Dings Separator is installed only after a study of conditions.

No Slacking in Demand

Commercial Building Takes the Lead, Passing Housing Construction. Road Building Materials Remain Active

By Our Eastern Correspondent

ALTHOUGH new construction operations have declined in volume at New York during the past few weeks, there has been no marked decrease in the demand for sand, gravel, crushed stone and affiliated materials. Projects are being pushed to completion, and the entire building supply list, with exception of brick, is reaching a point where consumption is larger than incoming supplies.

The outlook for the fall season in this section is decidedly favorable. This is true particularly of commercial buildings, which now promise to pass housing developments, so keen in the lead for some time past. With such a trend, dealers are looking for more stable conditions in the industry. Building contracts are now approximating $5,000,000 to $6,000,000 weekly in the New York district. There is a plentiful supply of men for this season of the year, skilled and unskilled.

Concrete aggregates have formed a center of interest for the past fortnight. Such materials, well in demand, show a strong tendency to depleted supplies, with resulting rigidity in price and keen anxiety to place immediate orders for early future deliveries.

Gravel has been enjoying a peak demand with "tightness" in present holdings. This material usually has its biggest call at this season of the year, and current business certainly has been no exception to the rule. Wholesale quotations remain at $1.75 a cubic yard for standard 1½ and ¾-inch grades, and $2.75 among the dealers for stocks delivered on the job.

Good washed sand is in active call, with a wholesale figure of $1.00 a cubic yard in cargo lots, alongside dock. The price a year ago was $1.25. Building supply yards are turning the material at $2.00 a cubic yard, and frequently $2.10 and $2.15, delivered to destination. Fine white sand is selling at $4.50 a cubic yard retail.

While road-building operations are drawing to a partial close in the eastern districts, there is still a fair call for crushed stone from contracting interests. Dealers supplying materials for road work believe that this will be one of the biggest years in this direction. In the wholesale market, crushed stone is priced at $1.75 and $1.85 per cubic yard, 1½ and ¾-inch stocks, respectively, carload shipments. Retail, the yards are charging $3.00 a cubic yard, both sizes.

Portland cement maintains under a favorable selling market, and many barrels of the material are being absorbed in New York construction enterprises. Dealers are paying $2.15 a barrel in the city, alongside dock, with delivered stocks at the yards or destination, holding at $2.50. Retail, $3.00 a barrel.

At Boston good washed gravel is being turned at $1.40 a ton, wholesale, 1½ and ¾-inch material cargo shipments. Sand is being sold to contractors and dealers at $1.00 per ton, carload lots, and at retail, $1.75 a ton, delivered. Crushed stone is $1.40 and $1.45 a ton, wholesale, with supply companies quoting $2.50 a ton, delievered by truck to destination. Portland cement is being secured from the mills at $2.64 a barrel, f.o.b. Boston; dealers are asking $3.45 and $3.50 per barrel for delivered stock.

The Pittsfield Lime & Stone Co., Pittsfield, Mass., is arranging an expansion program at its plant at Richmond Summit. It is proposed to install a new stone-crushing plant, hydrating plant, four kilns, and equipment for large increase in present output.

At a recent gathering of members of the New York State Stone Association, a tour of inspection was made of the plants of the General Crushed Stone Co., and the LeRoy Lime & Crushed Stone Co., both of LeRoy, N. Y. The party included about 30 members and guests.

There has been marked activity at the slate quarries in the vicinity of Slatington, Pa., during the past month, and a number of plants have added to their working forces for large increase in production. Improvement and expansion are also the order of the day at a number of the quarries, and considerable machinery has been reaching this district for installation. At the Blumont Slate Co., works, Slatington, an addition is being constructed to be used primarily for finished slate material for school slate manufacture.

The Evolution of Speed Reducing Equipment

By FRANCIS A. EMMONS*

SINCE the earliest days when man first emerged from the precarious hand to mouth existence of the stone age, he has been constantly striving to increase his productive capacity. He soon learned the limitations of work performed by his hands alone, and as he was endowed with the power to think and reason, he began to devise ways and means to supplement the work of his own hands, first by the work of domestic animals and then by mechanical contrivances.

The first use of mechanical power dates far back into the dim ages of history. The Egyptians had a marvelous knowledge of mechanics and the application of power in some form. This is demonstrated by the pyramids and other mighty structures built of stone so large as to make modern engineers wonder how they could possibly have been raised into place.

The treadmill, wind mill and water wheel, are familiar forms of power generators in mediaeval days, but the real development of mechanical power as we know it, has occurred in the last one hundred years, following the invention of the steam engine and later of the internal combustion engine, electric generator motor and turbine.

The amazing structure of modern industrial activity with its hundreds of ramifications, rests almost entirely upon the myriad applications of mechanical power by man to perform tasks of almost every conceivable nature. Modern machines perform with precision and accuracy, any operation from the delicate minute work involved in the making of the balance wheel of a watch to the manufacture of a huge Naval gun, weighing hundreds of tons.

The performance of a task by a machine demands that the power for running the machine be delivered at a certain fixed rate of speed depending upon the work the machine is to do. In most cases, this speed is lower than the speed of the steam engine, motor or other source of power and some means must be provided to "step down" the speed to the proper figure.

Speed reduction equipment is, therefore, a vitally important factor in nearly every industrial operation. This is particularly true in connection with modern material handling equipment, such as stokers, conveyors, feeders, elevators, hoists, etc., which operate at a very low ratio of speed and which play such a large part in volume production and in holding down production costs.

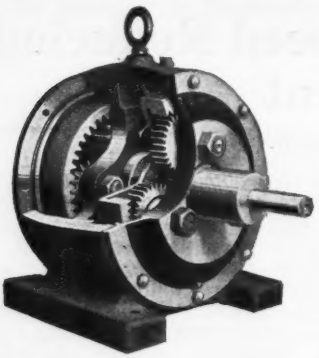
Pulleys and belts, chains and sprockets, rope drives and open gearing are well known forms of speed reducing equipment and are extensively used in nearly every industry. There is, however, another form of speed reducing equipment which is less widely known, but which, for certain purposes, has a number of outstanding advantages.

During the last thirty years, several well known manufacturers realizing the need for compact self contained speed reduction units, especially in connection with modern direct drive from electric motors, have developed and placed on the market units known as "Speed Reducers." Those Speed Reducers consist of trains of spur gears mounted in an enclosed frame resembling that of a motor, and their purpose is to step down the speed of an electric motor or other source of power to that speed required for any machine or special purpose.

One of the most outstanding contributions to this development of speed reduction units is the non-planetary spur gear reducer, produced by the Foote Bros. Gear & Machine Co. of Chicago.

In the design of this machine, the power is delivered to a pinion revolving between three idler gears which are rigidly journalled to parts of the frame. These idler gears in turn, transmit the power to a large internal gear. In this way the strain is ideally distributed to the idler gears and the final horsepower is taken from the largest possible leverage which is the pitch radius of the large internal gear.

*Foote Bros. Gear and Machine Company.



Internal Mechanism of IXL Spur Gear Reducer.

It should be borne in mind that nothing revolves in the gear case except the gears on their own centers. There are no heavy unbalanced units; vibrations, centrifugal force and oil leaks, caused by internal pressure, are eliminated.

The slow speed pinion is keyed to the high speed internal gear, and for greater speed reduction, engages with another set of idler gears which in turn drives another internal gear. Thus it is apparent that it is possible to secure almost any reduction ratio by simply increasing the number of gear trains and varying the ratio of the pinions and gears.

The cuts accompanying this article illustrate the simple construction of the single reduction unit, also the double, triple and quadruple type, simple and compounded. Any speed reduction from 4-1 up to 320-1, is covered by the different types shown and reduction ratios as high as 50,000-1 may be secured by combinations of spur gear reducers and worm gear reducers.

The Spur Gear Speed Reducers are entirely enclosed and run in a bath of oil. They are very compact, take little space, deliver the power with very little loss and the driving and driven shafts are axially concentric.

The chief advantages of the enclosed speed reducer unit drives are:

(1) Safety to operators and attendants because Reducers are fully enclosed and there are no exposed moving parts.

(2) Efficiency because the drive is positive and there is no lost power due to slippage, etc.

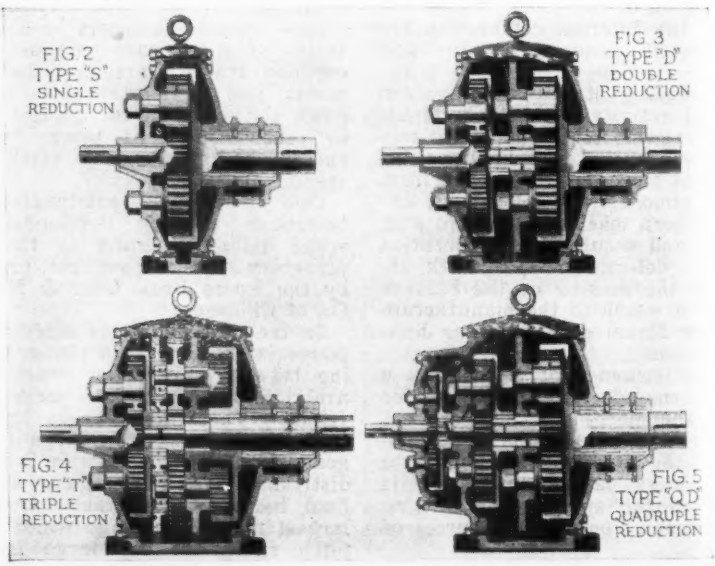
(3) Constant speed reduction.

(4) Long life, because they are self lubricating and there is no possibility of deterioration from dust, dirt or grit, or acid fumes in the atmosphere.

(5) Require practically no attention except to renew oil at three month intervals.

(6) Eliminates production delays, because no necessity for adjustments on bolts, slide rails, etc.

(7) Maintenance charges — practically nothing.



(8) Permit the use of high speed motors which cost less and are more efficient and easier to secure.

(9) Conserve space and allow of installation of productive equipment in space formerly occupied by belts, slide rails, hangers, shafting, etc.

(10) Better working conditions for employes, better light on account of elimination of shadows from belts and shafting.

Spur Gear and Worm Gear Speed Reducers are being widely used in nearly every industry and are being extensively specified by designing and consulting engineers for new equipment. They are particularly well adapted for operating screw, belt and bucket conveyors, stokers, feeders, hoists, elevators, rotary kilns in cement plants, car pullers, agitators, slurry tanks, water screens, crushers, grinders, dyeing and bleaching machinery in textile plants.

In cement mills, brick plants and mines, the dust, dirt and grit has no effect on the enclosed speed reducers. Grain Elevators and Mills find them particularly valuable because they eliminate the fire hazard incident to hot bearings on line shafts.

The uses and applications are almost innumerable and the list below covers only a few of the main industrial operations where speed reducing units are now being used with gratifying results:

Cement Mills—for driving rotary kilns, slurries, grinders, mixers, elevators, conveyors, etc.

Lumber Mills—for conveyors and feeders in connection with the various sawing and planing operations.

Coal and Metal Ore Mines—for conveyors, elevators, ore roasters and crushers.

Grain Elevators—for elevator legs, cleaner house conveyers, etc.

Glass Factories—for lehr and elevator drives.

Automobile Factories—for assembly conveyors.

Brick Plants—for conveyors and machinery drive.

Coke By-Products—for belt conveyor drives, pumps, etc.

Cereal Mills—for cookers, pumps, elevators and conveyors.

Textile Mills—for driving manufacturing machinery.

Paper Mills—for driving agitators and filters.

Steel Mills—for driving roller tables.

Plating Rooms—for agitator tank drives.

Rubber Mills—for conveyors, rolls and mixers.

Starch and Glucoso Mills—for conveyors, mixers and drives.

Paint and Chemical Mills—for mixers, conveyors and crushers, paint chasers and dryers.

Machine Shops—for line shafts, conveyors and machine tool drives.

Sugar Refineries—for screw conveyors and material elevator drives.

Boiler Rooms—for coal conveyors, stokers and ash conveyors.

It is a far cry from the stone age to the modern era of intensified industry and quantity production, but man's instincts still remain the same and the means at hand for industrial development have been multiplied a thousand fold. Possibly the results which have been secured in many industries through the use of modern speed reduction equipment, may act as an inspiration to those in other fields where the same problems prevail.

Foote IXL Speed Reducers

Another handsome, finely illustrated catalog has been issued by the Foote Bros. Gear and Machine Co. of Chicago. This book contains 79 pages, and deals with the subject of IXL Spur and Worm Gear Speed Reducers. Many installations are shown of IXL Reducers in operation, together with descriptions, also many illustrations of parts.

There are various tables of dimensions; fifteen pages of ratios, weights and prices of IXL Worm Gear Reducers; six pages of replacements; seven pages of price lists on Spur Gear Reducers; and other information.

A curious installation shown is that of an Amphibious Dinosaur Brontosaurus, 47 feet long and 9½ feet high. This mechanical beast employs ten electric motors to operate its eyes, head, neck, hips, stomach, sides, and tail. Ten IXL Reducers are used in connection which provide speed reduction in the ratio of 50 to 1.

Refractory Facts, a handbook containing 150 pages of information on fire-clay products, has been published by the Walsh Fire Clay Products Co. of St. Louis.

High Records in Loadings

How the Sand and Gravel Industry Stacks Up in Use of Transportation Facilities. Soft Coal Loadings Reported

By Our Washington, D. C., Correspondent

STATISTICS compiled by T. R. Barrows, Secretary of the National Sand and Gravel Association, and Donald D. Conn, Manager Public Relations Sections, American Railway Association, show that the sand and gravel industry is the only one in the country showing increased car loadings so far this year.

There has been almost a steady increase in car loadings, week by week, as shown by the open top car report of the American Railway Association. The report for the week ended, September 13, shows a total loading of 62,878 cars of sand, gravel and stone. This is an increase of 5,241 cars over the preceding week, and an increase of 5,470 cars over the corresponding week of 1923. The loading of 62,878 cars for the week ended, September 13, is the highest loading on record for any single week in the history of the industry, and indicates that the industry is maintaining the volume of business which it has done during the entire year.

Mr. Conn has written a letter to Secretary Barrows in which he expresses appreciation of the sand, gravel and stone industry in its efforts to utilize transportation facilities during periods of car surplus, stating that the sand and gravel industry was the only major item of transportation that was giving more business to the railroads this year, compared with 1923. The letter follows:

"For the first eight months of 1924, there were loaded 1,364,101 cars of sand, gravel and stone, as compared with 1,259,377 cars for the same period of 1923, or an increase of 104,724 cars.

"We desire to thank the sand and gravel people for their splendid cooperation and the results obtained in our efforts directly and through the Regional Advisory Boards to secure an early movement of commodities and avoid all possible congestions and shortages during the Fall period.

"It is a fact that these commodities are the only ones which show substantial increases over last year, indicating that builders have made more efforts to store in advance in preparation for fall and winter demands."

Mr. Barrows replied to Mr. Conn, stating that it will be the purpose of members of the National Association to continue the cooperation which they are giving the carriers in securing full utilization of railroad equipment.

Secretary Barrows has received reports from the U. S. Geological Survey indicating that production of soft coal is rapidly approaching normal for this time of the year. During the week ended September 20 the production was 9,902,000 tons, an increase of 373,000 tons over the preceding week. As a result of this increased production of coal there has been a few complaints to the Washington office of car shortages. Secretary Barrows has investigated these and has sent this communication to members:

"It is well for all members to watch their car supply situation carefully. The most satisfactory way of keeping an accurate check is to make a written request daily for cars. If there are any indications of shortages, the matter should be brought promptly to the attention of the Washington office. At this time there is no justification for restricting car supply for the sand, gravel and stone industry, and if any carrier is limiting movements of our materials to those in direction of the mines, they are acting without authority."

The executive committee of the National Sand and Gravel Association will hold an open meeting at Terre Haute, Ind., on October 21, and producers of District No. 11 and all others interested in the welfare of the industry in the promotion of the wider use of sand and gravel are invited to be present. The Chattanooga open meeting of the executive committee, when a score of men gathered at luncheon and discussed problems of mutual interest, was of benefit to all present, Secretary Barrows says, and he believes that these sectional heart-to-heart talks will iron out many of the problems of the industry.

Babcock Resigns From Byers Co.

The Byers Machine Co., of Ravenna, Ohio, announces the resignation of L. A. Babcock, for the past nine years sales manager, which took effect September 15th. The change gives Mr. Babcock time to devote to growing outside interests.

John Jones & Co. Installs New Hoist

Description of New Type of Hoist Which Was Recently Installed in an Old Indiana Sand and Gravel Plant

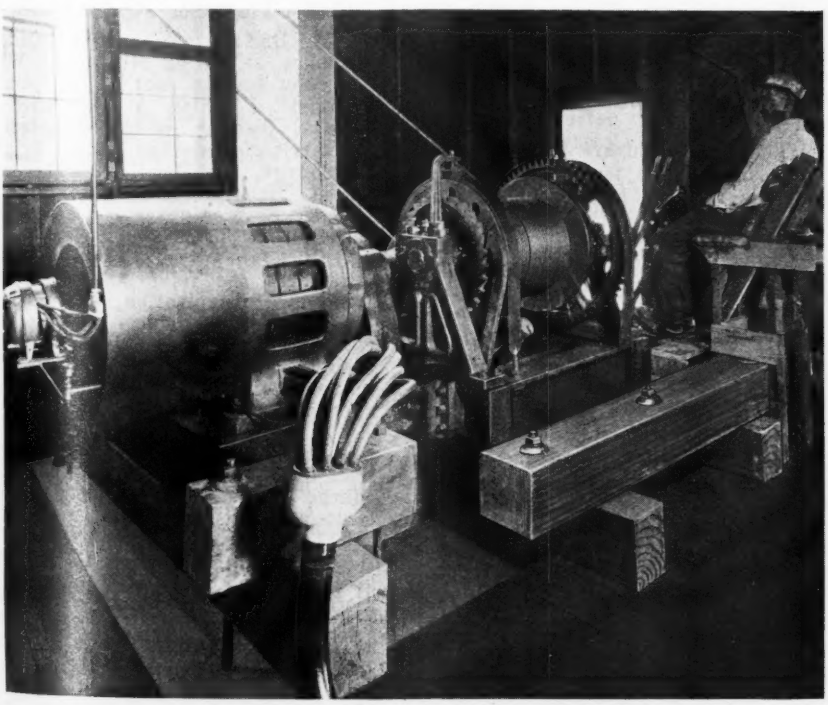
ONE OF Indiana's oldest cableway plants, the John Jones & Sons Co., of Indianapolis, a description of which appeared in the July issue of PIT & QUARRY, not long ago replaced its old power unit and its 75 H.P. electric motor with a Sauerman two-speed electric motor and a Sauerman 1 yd. bucket, as shown in the accompanying illustration.

This company's Sauerman Slackline Cableway was installed in 1915, before the days of special hoists designed solely for cableway operation. In its nine years of service the cableway has handled a quantity of material, but of course the old time hoist was slow and the change to the improved two-speed hoist was natural when the company desired to increase its output without dismantling its plant and putting in entirely new equipment.

The new hoist has given satisfactory increase in production because as much as 450 cu. yds. can now be handled by the 1-yd. bucket in ten hours, if necessary.

One outstanding feature of this new type of hoist is its remarkable simplicity. It has very few gear contacts, bearings and other wearing parts. Obviously, such reduction in the number of gears, bearings, etc., reduces the frictional losses and results in greater efficiency and decreased power consumption. It is axiomatic that the fewer the number of wearing parts, the less the risk of breakdowns, troubles and delays. Especially should this axiom be kept in mind when designing machinery that must undergo the continuous and severe duty of the usual sand and gravel pit operation.

Another important feature of the new hoist is the method of accomplishing the change from low speed for digging to high speed for inhaul-



Jones' Hoist House and Sauerman Two-Speed Motor Power Unit.

ing the loaded bucket to the dumping point. The change of speed is accomplished electrically by a two-speed high torque motor, specially designed for this service. This motor has two windings in the field, one for slow speed and one for high speed. The introduction of current to one winding causes the motor to deliver a high qrtoue at slow speed while the bucket is digging. Then, when the bucket is to be hauled in, the current is cut off from the slow speed winding and introduced to the other winding, causing the motor to revolve at high speed. The motor has the necessary power to both tension the track cable and inhaul the load at the same time.

Changes of speed from low to high or from high to low are brought about by the operator moving a small control lever mounted on a pedestal directly in front of the operator's stand. This control lever is moved forward or backward as high or low speed or entire cessation of operation is desired, the actual changes of speed being effected through an automatic magnetic control panel that is furnished as part of the equipment. All variations of speed are thus accomplished automatically and smoothly without any shocks whatever and without stopping the revolving of the drums or the movement of the bucket.

The control levers have been designed so as to make the operation of this type of hoist as simple and easy as possible, the idea being to relieve the operator of any great labor and thus increase his efficiency which in turn is reflected in larger yardage production.

By means of this two-speed electric hoist and other two-speed Sauerman hoists (steam, gasoline and belt-driven) that are of comparatively recent development, it is now possible to handle more yardage and operate over longer spans with Sauerman slackline cableway excavators than was deemed possible a few years ago.

Bulletin No. 98, illustrated, containing 24 pages description of G. W. Material Handling Equipment, has been issued by Gifford-Wood Co. of Hudson, N. Y.; also *Bulletin No. 24*, which describes G-W Portable Flight Conveyors.

Northwest Engineering Office

A new southern office has been opened by the Northwest Engineering Co. of Chicago, manufacturers of shovels, cranes, and draglines, in Atlanta, Ga., 101 Marietta street with M. B. Ogden in charge as district manager.

General Motors Changes

General Motors Company announces the appointment of T. J. Keller, general manager of General Motors of Canada, as vice-president of the company, and J. H. Beaton as general sales manager.

Westinghouse Announcements

The entire turbine blading department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is to be moved from East Pittsburgh to the South Philadelphia Works at Lester, Pa. It is also announced that the capital stock of the company was increased from $125,000,000 par value to $200,000,000 par value, in June last.

Cutler-Hammer Appointments

The Buffalo office of the Cutler-Hammer Mfg. Co., Milwaukee, Wis., has been made a part of the Central District of which A. G. Pierce is general district manager, including the territories covered by the Buffalo, Pittsburgh, Cleveland and Cincinnati offices. Headquarters will be in Pittsburgh. B. A. Hansen is manager of the Buffalo office.

G. S. Crane, general sales manager, announces the following changes in the sales organization; this divides the company's products into the two classes, engineering and merchandising: C. W. Yerger, formerly manager of the Boston office, is manager of the eastern district, relieving T. D. Montgomery. Mr. Montgomery has been moved from the eastern district to be assistant sales manager in charge of engineering sales, and is located at the main office in Milwaukee. A. H. Fleet, former manager of the specialty department at Milwaukee, now has charge of the sale of all merchandising products. J. M. Fernald is taking Mr. Yerger's place as manager of the Boston office. J. U. Heuser, formerly of the Chicago office, has been put in charge of a Milwaukee branch sales office, just opened.

Texas a Mighty Busy Builder

Many Counties Very Active in Road Building and Repairing Just Now Dallas Active in Building Construction

By Our Dallas, Texas, Correspondent

BUILDING operations in Dallas and other Texas cities continue on the increase, and road and street work is being undertaken on still larger scales, all of which tend to increase the demand for sand and gravel. Dealers in these building materials have experienced a period of unusual activity, and there are no signs of a let-up in the near future.

The market for these building materials continues firm with prices steady. Gravel is selling at $1 to $1.25 per cubic yard, f.o.b. cars at pits, while sand delivered on the job in Dallas brings $2.00 to $3.50 per cubic yard. Prices for sand delivered on the job vary greatly on account of the varying distances to be hauled, nature of roads and other conditions affecting delivery. A noticeable increase in the number of large motor trucks making deliveries of sand and gravel in Dallas indicates the increasing demand due to the increase in building operations.

Most of the gravel used in concrete work in Dallas is pit-run gravel, which has the proper mixture of sand and gravel for good concrete mix. This is used for all rough concrete work, as it saves expense of screening and remixing.

The J. Fred Smith Gravel Company, one of the pioneer gravel firms in Dallas, is operating on full time, handling most of its products direct from the pits to cars for shipment to nearby towns for building operations or road work.

The West Dallas Sand and Gravel Company has increased its fleet of motor trucks to care for increased demands for sand and gravel in Dallas. This company delivers by motor truck and teams from its pits on the Trinity River just west of Dallas. Much of its gravel is being used in street paving in Dallas.

The City Commission of Dallas has recently ordered 65 streets paved and is preparing to put two additional surveying crews in the field to get data on which the city engineer can calculate cost of paving to the property owners. The new paving program upon which the city is now entering calls for the laying of more than 50 miles of concrete pavement, surfaced with a macadam or bithulithic surfacing.

Building operations in Dallas at this time also require large amounts of sand and gravel. The Santa Fe Terminal building and system of warehouses, now about one-half completed at a cost of about $8,000,000, is making heavy demands on the sand and gravel pits of Dallas. The 20-story office building of the Republic National Bank, and several other large down-town projects are also using sand and gravel in large quantity.

Road building projects of Dallas county, marking consummation of the program entered on several years ago when a bond issue of $6,500,000 was made available, are going forward, and the county is purchasing considerable sand and gravel from private companies in addition to operation of its own gravel pits. Road construction and street improvement are general throughout the state. The State Highway Department has recently taken over the maintenance of all state-designated highways, under legislation enacted at the recent session of the State Legislature, and this is proving satisfactory. Highways are now being repaired and put in good order.

Clay County has started a force of engineers running lines for its new 34-mile concrete highway that is to be constructed along the Gulf-to-Colorado highway across the county. Williamson County Commissioners have directed that bids be received on construction of 23 miles of graveled highway from Georgetown to the Bell County line on the north.

Stamford, Jones County, has voted $500,000 in bonds for constructing hard surface highways in Jones County. The Thorndale Precinct in Milam County has voted $125,000 in bonds for completion of a six-mile gap in the concrete highway from the Brazos River to the Williamson County line.

The Electra Precinct in Wichita County has voted $500,000 bonds for building hard-surfaced highways around that town, which will include one to Lake Kemp, 15 miles south.

Freestone County has voted bonds of $1,000,000 for building good roads in that county. Tom Green County has awarded contract for 9.6 miles of hard-surfacing on State Highway No. 9 to Metcalfe & Thompson of San Angelo at cost of $90,499. Surfacing is to be of concrete.

Corsicana is in the midst of a paving program, which calls for the paving of the down-town business district at a cost of about $500,000. City of Ennis awarded contract for street paving to Central Bithulithic Company of Dallas. New Boston, Bowie County, has voted $130,000 for building good roads.

Malone, Hill County, voted $150,000 in bonds for highway construction. The City Commission at Amarillo, Texas, has ordered laying of 70 blocks of street pavement. Wilson County Commissioners' Court has a bond issue of $315,000 and proceeds will be used in building good roads leading out of Floresville, the county seat.

Commisisoners' Court of Taylor County, at Abilene, will have $1,000,000 to spend in highway construction, with the decision making the proceeds of the bond issue of $350,000 recently voted available.

J. Fred Smith of Dallas, pioneer sand and gravel dealer, has been elected as the first mayor of University Park, a recently organized municipality adjoining Dallas on the north and including the developed district about Southern Methodist University.

The Salado Gravel Company of San Antonio has filed an amendment to its charter increasing the capital stock from $12,000 to $30,000.

Activities In The South

Much Road Building in Progress Production from Sand and Gravel Pits and Stone Quarries This Fall

By Our Memphis, Tenn., Correspondent

QUARRIES, SAND and gravel pits in the Mississippi Valley and in Kentucky and Alabama are quite active this fall. The season is well advanced, September being the coldest at Memphis in five years, yet sufficiently warm for favorable out door operations of every kind and little rain as yet.

Construction activities are very heavy in all the larger Southern cities. Memphis just completing her three new sky-scrapers still has numerous apartment houses, one twelve-story hotel, a big sub-way, several paving projects, the Shelby county jail project, numerous school and church jobs of magnitude, all having a large quota of stone, clay products and cement materials.

Road building is very active in the tri-states, Tennessee in particular. Two of the largest contracts of the year, or for that matter in the history of the Highway department, were let in June and August in each of the three divisions. The work is getting under way and in a few weeks the third and final letting of the year will be made at Nashville.

Nashville also is very active in construction. One twelve-story hotel project is under way there, to be completed by September, 1925. The Capitol Annex and War Memorial is also progressing. This is a $2,000,000 structure of stone, taking two years to build. The DuPont Silk Fiber Co. is starting a large group of buildings at Old Hickory near Nashville, much cement work being used. A publishing house and a packing industry are among other Nashville jobs of the season.

Birmingham's building record has already gone beyond $12,000,000 and is expected to reach $20,000,000 before the end of the season. New Orleans has several large sky-scrapers, store annexes and numerous public and semi-public structures, swimming pools, etc., with much concrete work. Dallas is starting the new $4,500,000 Baker Hotel to be completed next year with large frontage on Arkard and Commerce St.

Exhibits in cement, sand and clay products, lime and sewer pipe will be shown at the Tri-State Fair at Memphis, Sept. 20 to 27, by Fischer Lime and Cement Co.

A lease on a new gravel bed, four and one half miles north of Benton, Ark. and right of way across a mile of farm land were obtained by the Little Rock-Hot Springs Highway Commission a few days ago. Several large paving and road building projects have been contracted in that section. Arkansas as a state has an elaborate 1925 road building programme.

New Union Universal Boiler

A book describing in detail the design and construction of their new Union Universal Boiler of the self-contained return flue type has been issued by the Union Iron Works. Both interior and exterior views as well as sections through the boiler are shown, and a table giving data on all dimensions of importance.

The Universal Boiler is made in sizes from 25 to 150 H.P. and is adaptable to a wide range of conditions.

Indiana Provides Employment

Public Service Commission Refuses to Modify Order Reducing Sand-Gravel Rates. New Deposits

By Our Indianapolis, Correspondent

THE INDIANA public service commission, in an order just announced, refuses to modify its recent order, in which it directed certain railroads to establish reduced rates on sand and gravel from New Albany. The rates established by the commission were "graduated with due regard for the distance involved and are approximately in line with other rates fixed by the commission in cases involving rates on sand, gravel and building material," says the order. The commission says it sees no reason why the order should be modified.

Indiana's conservation commission has assumed the role of state development bureau. Its geology division through Dr. W. N. Logan, state geologist, has pointed the way for utilizing mineral resources in order to provide employment for more than 1,000 idle miners thrown out of work through inactivity in the Clinton coal fields.

Dr. Logan's report shows rich deposits of natural resources for making road materials, large deposits of sand and gravel generally free from clay, organic matter or other detrimental substances, which are useful in many types of construction, namely concrete, as building sands, as road materials and other purposes, also cement, glass, ceramic materials and materials for ferro-silicon manufacture. The quantity of such materials in the Wabash Valley at Clinton is unlimited, he says.

Dr. Logan and his assistants found deposits of white sand in the vicinity of Coxville east of Clinton. This sand is suitable for manufacturing glass ware of certain grades, particularly glass bottles. Fuel necessary for the manufacture of glass can be obtained in almost any quantity in the Clinton area, while the limestone used for flux can be obtained from the Bloomington-Bedford quarry district in the form of waste-stone from the quarries. The sand also may be used in the manufacture of ferro-silicon which is manufactured from the iron and silica by the use of electric furnace, Dr. Logan points out. Electricity may be generated by the use of coal from the Clinton area. Possibly the iron from the shale beds can also be used for this purpose.

The survey shows deposits of glacial and alluvial clays existing in the Clinton district, covering much of the surface outside of the stream valleys. These clays, according to the state geologist, are suitable for the manufacture of common brick and soft, porous agricultural tile. Shales belonging to the coal mines of the area can be very profitably used in the manufacture of vitrified brick, serviceable for face brick and paving brick. They may also be used in the manufacture of sewer pipe, silo staves and agricultural tile. The quality of the ware may be improved by the use of a mixture of the shale with a fire clay which underlies the coal beds of the area.

The shales occur in three sections west of Clinton and in such quantity as to supply a very large plant for a great many years. Exposures of the shale with a vertical height of from 20 to 30 feet are to be found along the courses of some of the smaller streams. These deposits have little overburden of earth and can be secured without the removal of a prohibitive amount of useless material. Also the deposits are near enough railroads so that they may be connected with transportation lines. Coal for fuel is present on the same land. Dr. Logan suggests quarrying the shales with steam shovels or drag lines as the most economical way.

Stone men in many of the southern counties of Indiana are hailing with delight the announcement of a new railroad which will bisect their section, running from Elnora, Ind., to Owensboro, Ky. It will be known as the Owensboro, Rockport & Chicago railway. According to the testimony the total cost of the road is estimated by engineers at about $6,500,000. The road will be 72 miles long in Indiana and twelve and one-half miles long in Kentucky.

More than 1,000 carloads of cement and gravel will be used in the construction of the hydro-electric dam at Oakdale near Lafayette, Ind. Work on the $2,000,000 enterprise is well under way and when the unit is completed it will develop 12,000 horse power of electric energy.

U. S. Gypsum Rebuilds Plant

The United States Gypsum Company has just finished completely rebuilding the Sheetrock wallboard unit of its plant at Fort Dodge, Iowa, increasing its capacity to 225,000 feet a day and making this plant one of the three largest gypsum-working establishments in the world. This construction cost $150,000 and provides for further expansion up to a daily capacity of 50,000 feet more than the plant had before this year.

Authority for this operation was issued late in May. The Fort Dodge plant serves all the Northwestern states and the increase of its capacity was necessitated by the growing demand for fireproof gypsum wallboard in that teritory. The authority called for complete remodeling and reconstruction of the Sheetrock building, installation of a sprinkler system, substitution of a new continuous kiln for the old tunnel-drive kiln and entire rebuilding of the Sheetrock machine.

These changes were effected, without interruption to operation of the old plant, within four months after issuance of the authority. The wallboard machine was designed and built by the Gypsum Company and embodies all the improvements developed in its six other Sheetrock mills. On the first day of operation, it produced within 5,000 feet of its total capacity. This is the fourth considerable construction done by this company in 1924.

Hendricks New Register Out

The 32d (1924) edition of Hendricks Commercial Register is reported off the press. This new edition contains 155,000 corrections, and is said to be thoroughly up-to-date and complete.

Hendricks Commercial Register is described as the oldest, best known and most efficient publication of its kind in America, listing as it does all the worth-while concerns in practically all lines of industry. It is largely used as a buyers' guide, and is the product of an organization with 32 years of experience behind it.

A feature of subscription to this big directory is the privilege of calling on the publishers at any time for such special service as may be desired in connection with buying and selling. For this purpose, a well trained service department is maintained.

Robert June Corp. Moves

Announcement is made of the removal of the Robert June Engineering Management Corp. of Detroit from the present address, 8938 Linwood Avenue, to 8835 Linwood Avenue. The Robert June Corporation handles industrial advertising, and sales development and engineering management. This move, the second in six months, more than doubles the office space and provides better facilities for service to clients, also for the engineering library, and for research and data files.

Construction Costs Attacked From New Angle

This time, instead of coming through the lowering of the wages of skilled artisans, or the shrinkage of market prices of basic building materials, the pressure is through the heavier loading of structural steel.

Emphasis is evidently being made upon this phase of the building construction situation just now because of the settled trend of speculation toward industrial, commercial and mercantile enterprises to a degree far greater than has prevailed since 1916. The heaviest pressure for a modification of existing standard building construction practice in N. Y. city is being brought through the influence of great financial factors who have hesitated to proceed with commercial construction work so long as costs remained where they were.

These factors have learned that the New York State Legislature has accepted a new steel unit loading of 18,000 pounds, instead of 16,000 pounds as permitted in New York City and that this extension of load limit is now standard in the cities of Buffalo and Syracuse, Newark, N. J., Montclair, N. J., Kansas City, Providence, R. I., Los Angeles, Detroit, Cleveland, Washington, Atlanta, Boston, Baltimore, St. Paul and other cities.

The reports received from investors in those cities, according to information obtained from present and prospective investment owners of steel skeleton buildings in New York, is that winter construction has been demonstrated as being perfectly feasible. Investors have been told that an adjustment in the steel unit loading limit would result in the saving in actual weight and expense of about 12 per cent.

The New Egyptian Cement Plant Speed Reducers

By H. A. SPARROW, M.E.*

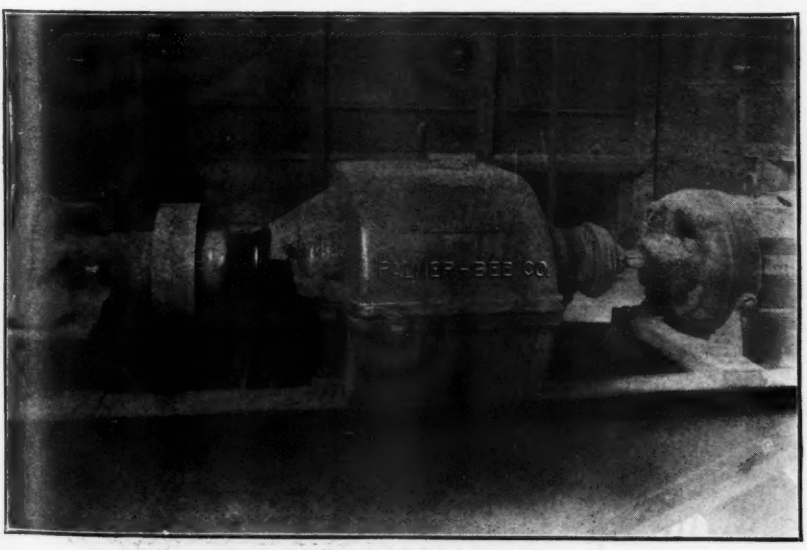
IN CEMENT plants where cement dust, grit and dirt are found in excessive amounts, the machinery in the plant has to run under the worst of working conditions. In order to maintain stiff production schedules under these conditions, the machinery and equipment must be designed so that it will do heavy duty work and operate continuously with the least amount of shut-downs and production delays possible.

The plant of the New Egyptian Portland Cement Co., Port Huron, Mich., is an excellent example of an efficiently operated cement plant, where continuous heavy production is successfully maintained. The plant is ideally located with regard to raw materials, market and transportation facilities. Detroit and the nearby counties are spending many millions of dollars annually on paving and road construction work. As a result there is a continuously heavy demand for the products of the New Egyptian Portland Cement Co. As a matter of fact, the company is regularly operated on the basis of producing 17 carloads of cement a day.

*Of the Robert June Engineering Management Organization of Detroit.

One of the biggest factors in the continuous dependable operation of the plant is the use of speed reducers with direct motor drive in place of open gearing, pulleys, belts and similar power-transmission systems, which has in the past been extensively employed for operating massive and slow moving equipment. Realizing that many machine breakdowns are primarily due to the failure of open gearing, pulleys, etc., exposed to accident hazard and the danger of not being lubricated, the New Egyptian company drives its clinker grinding machines, coal pulverizers, conveyors and elevators through the medium of speed reducers.

Speed reducers were not generally used by the company when the plant was first constructed, but because of their dependability and greater safety the company installed several speed reducers of the mill type in their plant some years ago. These worked so satisfactorily that additional equipment of this sort was purchased from time to time so that at present there are 15 speed reducers in service in different parts of the plant—all giving good results. The units vary in



Speed Reducer at Egyptian Cement Plant.

size according to the service for which they are utilized.

The speed reducers which play such a prominent part in the New Egyptian Portland Cement Co.'s production program are of simple construction. They are fully enclosed by a housing which is split on the center line and by removing four bolts the cover can be lifted off and the entire mechanism which is carried in the lower half of the casing, is open to inspection.

The reduction gears are all cut gears of the wide faced, coarse pitch involute type and the shaft on which the gears are mounted is a through shaft supported by two bearings, one on each end. The gears run in oil and the bearings are lubricated automatically which assures constant flooding of all moving parts with lubricant without the use of grease or oil cups.

All the reducers are subject to extremely dusty conditions, due to an excessive amount of cement dust and dirt found in all mills making cement and pulverizing their own coal. These conditions alone show the wide range of adaptability that the enclosed type of reducer has in this field over the open gearing, pulley or belt systems.

The reducers in this plant have stood up well under the working conditions present, very little trouble being experienced with them. Since their installation only one unit out of fifteen caused any trouble and that was a unit which was running very close to the discharge end of a kiln where it was subject to very intense heat at all times. After careful adjustment and keeping it well filled with oil this trouble was eliminated.

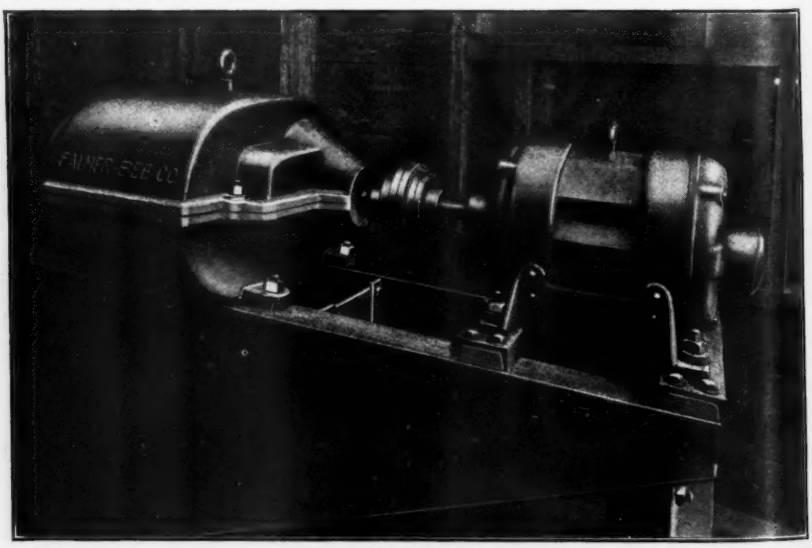
That the cement plants of the country are alive to the advantages of the speed reducer are shown by the increasingly large number of installations of this type of equipment, for both old and new work.

The illustrations accompanying this article are furnished through the courtesy of the Palmer Bee Co., Detroit, Mich.

Beaver Manufacturing Expands

The Beaver Manufacturing Company of Milwaukee, Wisconsin, builders of industrial engines for tractors, trucks and other equipment have acquired and are occupying 20,000 additional feet of floor space. This space was required to take care of the expanding business and is being used only as an Assembly and Testing Department.

The actual increase in engine business of this year over last year's showing is 69 per cent. This speaks well for the soundness and volume of the industrial field as an outlet for automotive equipment.



New Egyptian Installation Driving Coal Conveyors.

Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy fo you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs, prices or other information.

- ☐ Air Compressors
- ☐ Agitators
- ☐ Air Compressors, Portable
- ☐ Babbitt Metal
- ☐ Bag and Barrel Linings
- ☐ Bag Sewing Mach.
- ☐ Bags, Paper
- ☐ Bags, Cotton
- ☐ Bag Filling Machines
- ☐ Barrels, Steel
- ☐ Belt Fasteners
- ☐ Belting, Conveyor
- ☐ Belting, Transmission
- ☐ Bins, Clay Tile Storage
- ☐ Bins, Concrete Storage
- ☐ Bins, Steel Storage
- ☐ Bin Gates
- ☐ Blasting Powder
- ☐ Blasting Fuses
- ☐ Block Machinery, Concrete
- ☐ Boiler Compound
- ☐ Boiler Skimmers
- ☐ Boilers
- ☐ Box Car Loaders
- ☐ Brick Machinery, Concrete
- ☐ Buckets, Grab
- ☐ Buckets, Conveyor
- ☐ Buildings, Portable
- ☐ Cable Coatings
- ☐ Cableways
- ☐ Car Movers
- ☐ Cars, Bottom Dump
- ☐ Cars, End Dump
- ☐ Cars, Side Dump
- ☐ Cars, Steel Gondola
- ☐ Car Pullers
- ☐ Car Replacers
- ☐ Car Wheels
- ☐ Castings, Special Metal
- ☐ Chain, Conveyor
- ☐ Chain Drive
- ☐ Chain, Steam Shovel and Dredge
- ☐ Chaser Mills
- ☐ Classifiers
- ☐ Clips, Wire Rope
- ☐ Clutches
- ☐ Controllers, Electric
- ☐ Conveyor Equipment
- ☐ Conveyor Rollers
- ☐ Couplings, Flexible
- ☐ Cranes, Electric Traveling
- ☐ Cranes, Jib
- ☐ Cranes, Locomotive
- ☐ Cranes, Traction
- ☐ Crusher Parts
- ☐ Crushers, Disc
- ☐ Crushers, Gyratory
- ☐ Crushers, Hammer
- ☐ Crushers, Jaw
- ☐ Derrick Swingers
- ☐ Derricks
- ☐ Dippers
- ☐ Draglines, Cableway
- ☐ Draglines, Revolving Boom
- ☐ Dredges, Dipper
- ☐ Dredges, Land
- ☐ Dredges, Sand Suction
- ☐ Dragline, Scraper
- ☐ Drill Steel
- ☐ Drilling (Contract)
- ☐ Drills, Blast Hole
- ☐ Drills, Hand Hammer
- ☐ Drills, Tripod
- ☐ Drill Sharpening Machines
- ☐ Dry Pans
- ☐ Dryers, Sand and Stone
- ☐ Dump Wagons
- ☐ Dust Collecting Systems

(Continued on next page)

Firm Name .....

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Address .....

City ..... State.....

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Remarks .....

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- ☐ Dynamite
- ☐ Dynamos, Electric

- ☐ Elevating Equipment
- ☐ Engineering Service
- ☐ Engines, Oil
- ☐ Engines, Gasoline
- ☐ Engines, Steam

- ☐ Feeders
- ☐ Fire Alarms
- ☐ Fire Alarm Systems
- ☐ Frogs and Switches
- ☐ Fuses, Blasting

- ☐ Gas Producers
- ☐ Gear Speed Reducers
- ☐ Gears
- ☐ Generators, Electric
- ☐ Grapple, Stone
- ☐ Grate Bars
- ☐ Grates
- ☐ Gypsum Separators

- ☐ Hoisting Engines
- ☐ Hoists, Chain
- ☐ Hoists, Derrick
- ☐ Hoists, Drum
- ☐ Hose, Sand Suction
- ☐ Hydrators
- ☐ Hydraulic Mining Nozzles
- ☐ Hydraulic Pipe
- ☐ Hydraulic Pumping Engines
- ☐ Hydraulic Valves (Pulpit and Indicator)

- ☐ Idlers, Belt Conveyor
- ☐ Industrial Railway Systems

- ☐ Kilns, Cement
- ☐ Kilns, Lime

- ☐ Lights, Carbide
- ☐ Loaders, Conveyor
- ☐ Loaders, Boom and Bucket
- ☐ Loaders, Bin, Portable
- ☐ Locomotives, Electric
- ☐ Locomotives, Gasoline
- ☐ Locomotives, Steam
- ☐ Locomotives, Storage Battery
- ☐ Log Washers
- ☐ Lubricators

- ☐ Magnetic Separators
- ☐ Manganese Steel Parts
- ☐ Mixers, Concrete
- ☐ Motors, Electric
- ☐ Motors, Gasoline
- ☐ Motor Trucks
- ☐ Motor Truck Dump Bodies

- ☐ Nozzles, Suction Screen

- ☐ Oils and Lubricants

- ☐ Perforated Metal
- ☐ Picks and Shovels
- ☐ Pipe, Iron
- ☐ Pipe, Spiral
- ☐ Plows
- ☐ Post Molds, Concrete
- ☐ Powder
- ☐ Power Transmitting Equipment
- ☐ Powder Magazines, Steel
- ☐ Pulverizers, Hammer
- ☐ Pulverizers, Roll
- ☐ Pulverizers, Ring
- ☐ Pumps, Drainage
- ☐ Pumps, Dredging
- ☐ Pumps, Sand
- ☐ Pumps, Water Supply
- ☐ Pump Repairs
- ☐ Pyrometers

- ☐ Rail, Steel
- ☐ Rope, Manila
- ☐ Rope, Wire

- ☐ Sand-Lime Brick Machinery
- ☐ Scrapers, Team
- ☐ Screening Equipment
- ☐ Screens, Rotary
- ☐ Screens, Vibrating
- ☐ Screens, Perforated Metal
- ☐ Sheaves
- ☐ Steam Shovels
- ☐ Steel Barrels
- ☐ Steel, High Speed
- ☐ Steel, Manganese
- ☐ Stokers, Automatic
- ☐ Stone Grapple
- ☐ Swinger, Derrick

- ☐ Tackle Blocks
- ☐ Tampers, Concrete Block
- ☐ Tanks, Settling
- ☐ Tanks, Steel
- ☐ Tanks, Wood
- ☐ Ties and Timbers
- ☐ Tile Machy., Concrete
- ☐ Tractors, Caterpillar
- ☐ Track
- ☐ Track Scales
- ☐ Transformers, Electric
- ☐ Tramways, Aerial
- ☐ Trolley Carriers
- ☐ Tube Mills

- ☐ Unloaders, Bin
- ☐ Unloaders, Conveyor
- ☐ Unloaders, Boom and Bucket

- ☐ Wagons, Dump
- ☐ Washing Equipment
- ☐ Welding Equipment
- ☐ Winches
- ☐ Wire Cloth

(See other side)

Firm Name .....

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Address .....

City ..... State.....

Remarks .....

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Morgan Issues Ingot Bulletin

A bulletin just issued by the Morgan Engineering Co. of Alliance, Ohio, is devoted to ingot stripping, and contains a description of their construction and operation with many illustrations—diagrams and halftones—of installations in large steel works.

Industrial Works Branch

Announcement is made by The Industrial Works of Bay City, Mich., of a new district office at 455 Monadnock Bldg., San Francisco, Calif., in charge of J. M. McGuire, for twenty years construction and erection engineer for the company, as district sales manager.

New Brown Hoist Catalog

A catalog describing continuous mechanical handling of bulk materials has just been issued by Brown Hoisting Machinery Co. of Cleveland, Ohio, featuring belt conveyors for various purposes. Sufficient general data are offered to aid in selection of equipment for particular purposes. Individual installations are illustrated and much descriptive information given.

A folder has been issued by the Buffalo Forge Co. of Buffalo, N. Y., which describes, with illustrations, the Buffalo "Breezo-Fin" Heater.

Easton Car Bulletins

The following illustrated bulletins have been issued by the Easton Car & Construction Co. of Easton, Pa., *No. 6* describes Easton Platform Cars; *No. 21*, Quarry Cars; *No. 14*, Turntables; *No. 33*, Roll-Over Body; *No. 36*, Transfer and Transformer cars; *No. 41*, One Way Cars.

Morse Chain Books

Three publications have been issued by the Morse Chain Co. of Ithaca, N. Y. "*A Chain of Testimonials*" is a collection of reports from executives on the use of Morse Chains in their plants. *Bulletins 24 and 26A*, entitled "*A Chain of Evidence*," describes the Large Power Drives and Small Power Drives respectively.

Bulletin T-220, issued by the Hill Clutch Machine & Foundry Co., Cleveland, O., describes the Industrial Type Spur Gear Speed Transformer, manufactured by the company.

Folder No. 407, illustrated, issued by the Bury Compressor Co., Erie, Pa., describes Bury Air and Gas Compressors and Vacuum Pumps.

Detroit Electric Furnace Catalog

"*Speedier Production—Better Brass*," is the name of a new catalog issued by the Detroit Electric Furnace Company of Detroit, Mich. This book describes in detail the performances, advantages, and results obtained with their electric brass furnaces in the brass melting field. It contains important and specific information with many illustrations, and enumerates and describes the outstanding features of economy, mechanical control and speed of production. Copies may be obtained on request.

Buffalo Electric Blowers

The Buffalo Forge Co. of Buffalo, N. Y., has issued a circular on Buffalo variable speed electric blowers, with new enclosed regulators which protect the vital parts of the machine from injury and the operator from shocks. The motors work satisfactorily on either direct or alternate current, single phase, 25, 40, or 60 cycle, and there is no danger of a short circuit or injury to workmen.

Mansfield Back-Dump Bucket

Mansfield Engineering Co. of Indianapolis has issued a 31-page illustrated pamphlet, describing the Pioneer back-dump bucket, which is built on the general design of a steam shovel dipper. This bucket is designed for slack-line cableway operation in sand and gravel.

Haiss Loader Catalog

The George Haiss Mfg. Co., Inc. of New York has issued a 27-page catalog describing its path-digging stone, sand, gravel and other loose materials. There are several pages of figures on loading capacities and costs as compared with hand shoveling. The loader is of the continuous bucket type mounted on crawlers.

New Chain Belt Officers

J. C. Merwin, works manager of Chain Belt Co., Milwaukee, Wis., has been elected to the position of second vice-president; Brinton Welser, secretary, and C. E. Stone, assistant secretary. The following were re-elected: C. R. Messinger, president; Clifford F. Messinger, first vice-president, and C. L. Pfeifer, treasurer.

A 20-page illustrated catalog, describing the Schaffer Poidometer, has been issued by the Schaffer Poidometer Co. of Pittsburgh, Pa.

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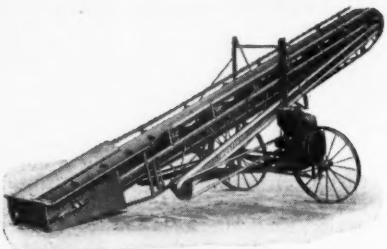

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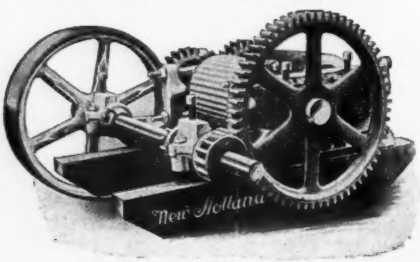

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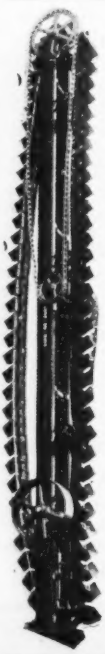

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